Respiratory

Version 5.3

Corrected, Updated, Lighter

PLAB 1 Keys is for PLAB-1 and UKMLA-AKT (Based on the New MLA Content-Map)

With the Most Recent Recalls and the UK Guidelines

ATTENTION: This file will be updated online on our website frequently!

(example: Version 2.1 is more recent than Version 2, and so on)

Key 1

Bronchiectasis

◙ **Bronchiectasis** → a permanent dilatation of the airways secondary to chronic infection or inflammation

◙ **Most common organisms isolated from patients with bronchiectasis:**

√ Haemophilus influenzae (most common)

√ Pseudomonas aeruginosa

√ Klebsiella spp.

√ Streptococcus pneumoniae

◙ Main Features:

Chronic Persistent Cough (+)

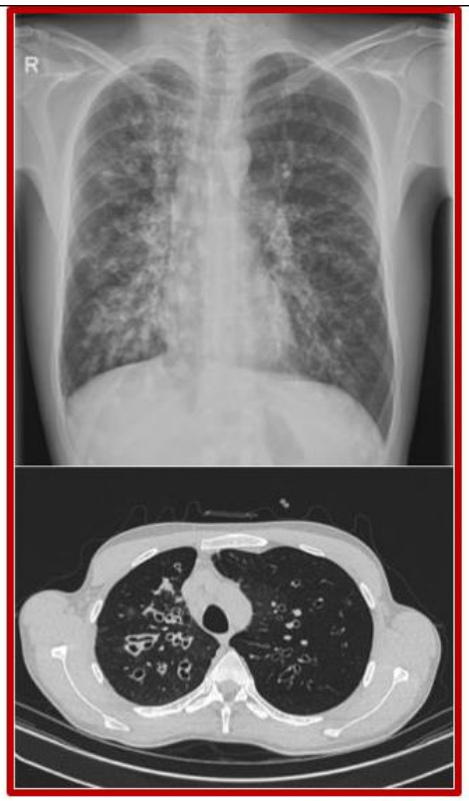
Copious Excessive Sputum (+)

Recurrent respiratory tract infections (±)

Others: weight loss, clubbing, dullness, crackles.

Suspect → **Bronchiectasis**

"***Irreversible dilatation of small and medium sized bronchi***"



bronchiectasis: tram-tracks, thick rings

◙ **Other features that may present in a stem**:

√ **Chest X-ray may show Tramlines "cysts/ ring opacities"**

"Chest X-ray is often normal"

√ **Clubbing "drumstick-shaped fingers"**:

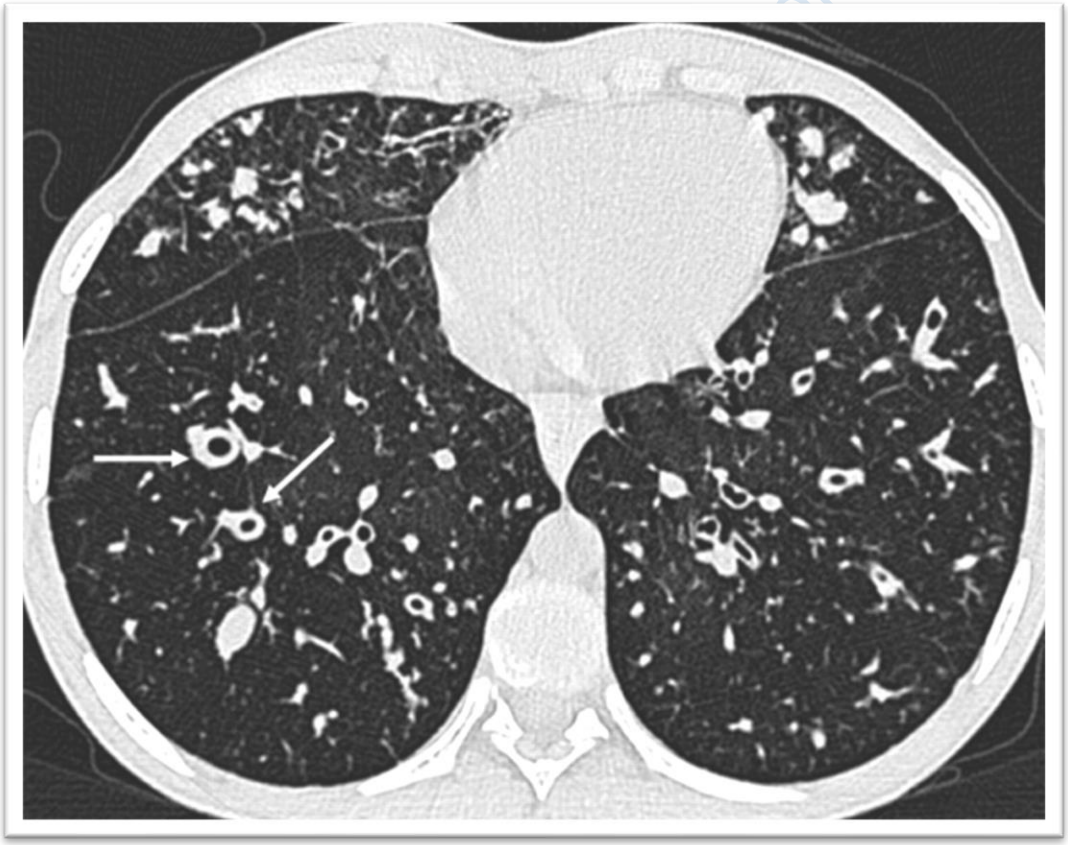
not always present, not specific.

Note that chest X-ray may be normal.

Note that chronic cough may cause hemoptysis.

◙ **To confirm the Dx**

→ **High resolution CT scan (HRCT). "Important. The goldstandard"**



HRCT of bronchiectasis showing → bronchial dilatation and wall thickening with ground glass opacities.

◙ What are the signs and symptoms of bronchiectasis?

√ chronic daily cough.

√ coughing up large amounts of thick mucus every day.

√ coughing up blood (1/3 of patients).

√ weight loss.

√ shortness of breath.

√ chest pain.

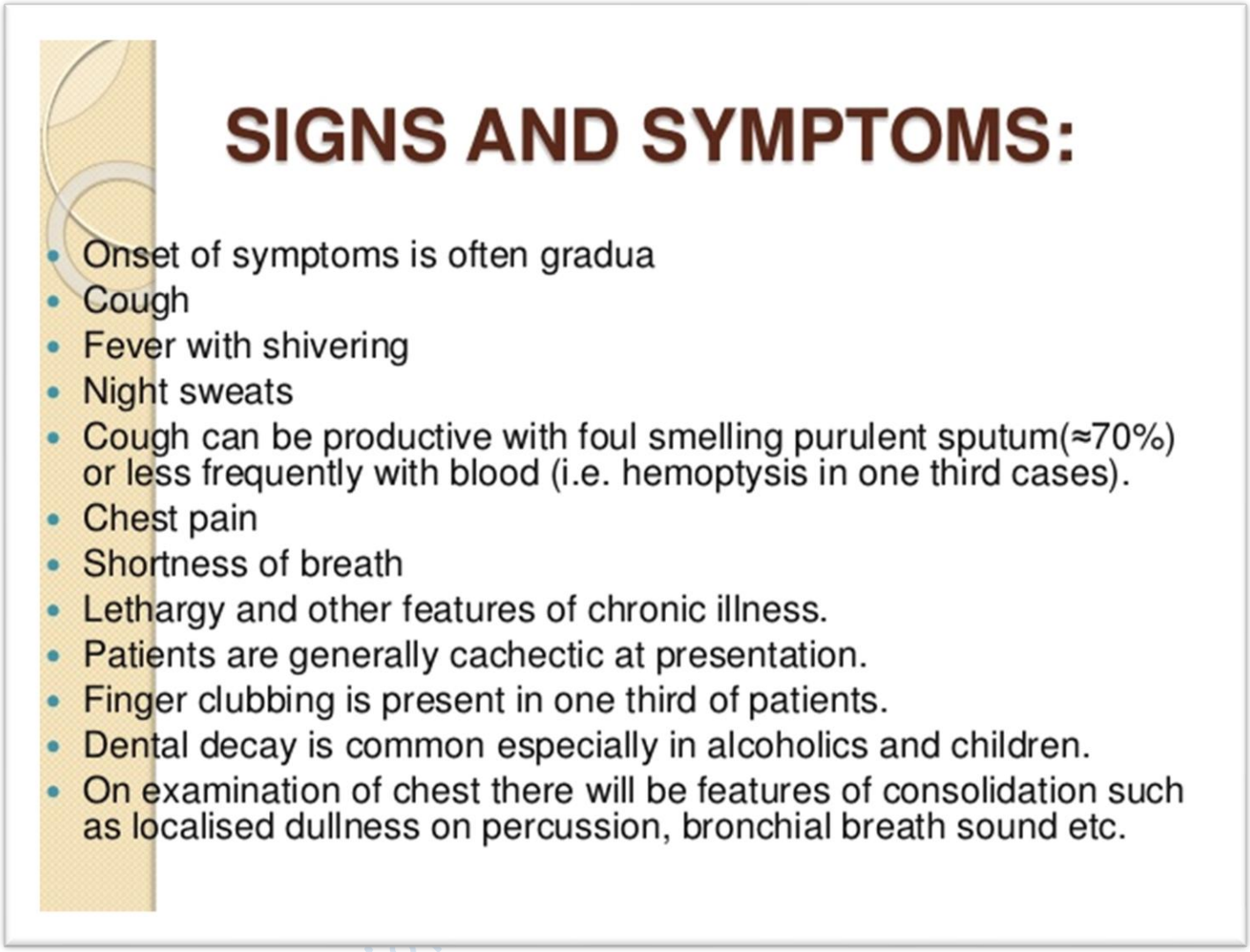
√ fatigue.

√ crackles, rhonchi, wheezing, and inspiratory squeaks may be heard upon auscultation.

√ General findings may include digital clubbing, cyanosis, plethora, wasting, and weight loss.

√ Chest X-ray ⟶ Tramlines "cysts/ ring opacities" OR Normal.

√ Percussion ⟶ Dullness.



◙ management of Bronchiectasis

Bronchiectasis describes a permanent dilatation of the airways secondary to chronic infection or inflammation. After assessing for treatable causes (e.g. immune deficiency) management is as follows:

√ Physical training (e.g., inspiratory muscle training) – has a good evidence base for patients with non-cystic fibrosis bronchiectasis.

√ Postural drainage.

	√ Antibiotics for exacerbations + long-term rotating antibiotics in severe cases bronchodilators in selected cases. √ Immunisations. √ Surgery in selected cases (e.g., Localised disease).
Key 2	**Criteria "features" for Life-threatening Asthma:** • **Altered mental status with drowsiness.** • **Silent Chest (Absent chest sounds)** • **Poor respiratory effort.** • **Exhaustion.** • **Cyanosis.** • **Arrhythmia.** • **Hypotension.** • **PEF < 33% predicted or best.** • **SpO2 < 92%.** • **PaO2 < 8 kPa.** • **PaCO2 is normal (4.6-6 kPa)**

Example (1)

A 3yr old boy with asthma presents to the A&E with acute attack of wheeze. He is drowsy and has cold periphery. His HR is 180bpm, he has intercostal recession and widespread wheeze. What is the most significant feature that shows impending respiratory failure?

A. Cold periphery

B. **Drowsiness**

C. HR of 180bpm

D. Intercostal recession

E. Widespread wheeze

Example (2)

A 3yr old boy with asthma presents to the A&E with acute attack of wheeze. He is cyanotic and has RR of 45. His HR is 180bpm, he has intercostal recession and widespread wheeze. What is the most significant feature that shows impending respiratory failure?

A. RR of 45

B. **Cyanosis**

C. HR of 180bpm

D. Intercostal recession

E. Widespread wheeze

Example (3)

A patient recently diagnosed of asthma which has been well controlled, now presents with increase respiratory rate, temp 36.7, auscultation reveals absent breath sound.

Which of the following will indicate life threatening asthma?

A. **Absent breath sound**

B. Increased respiratory rate

C. Intercoastal recession

Key 3

(Question 1)

- **Hx of being a worker "e.g., builder, a shipyard worker" (exposed to asbestos) [+]**
- **Shortness of breath ▌Chest pain ▌Weight loss [±]**
- **Clubbing, Recurrent Pleural Effusion**

◙ **Suspect** → **Mesothelioma** (Malignant tumour of mesothelial cells).

→ **Bronchial carcinoma**

◙ **To confirm the Dx** → **Pleural Biopsy** (not cytology).

◙ Malignant pleural effusion due to mesothelioma may require

→ **Long-term indwelling pleural drain**.

◙ Mesothelioma is seen in people exposed to **asbestos** such as:

√ Blue-collar Workers → Firefighters, construction workers (builders), power plant workers, shipyard workers and others in blue-collar occupations.

√ **Veterans** → Primarily military personnel who served in the U.S. Navy, but also those who served in the Army, Marine Corps, Air Force and Coast Guard, signet ring sign and finger in glove sign.

So, it is considered an **industrial disease, leading to "unnatural death"**.
Therefore, deaths of mesothelioma should be **reported to and consulted with** → a **coroner** as compensation is often available. "**important**"

(Question 2)

	A 57 YO man is admitted to ICU after having MI. He has a Hx of mesothelioma. A few days later he had cardiac arrest and died. Pick the correct answer: (A) Write MI as a cause of death. (B) Write Mesothelioma as a cause of death. I **Refer to a coroner before issuing a death certificate**. **(Question 3)** **A 60 YO retired builder has been having shortness of breath and chest pain for the past 6 months. He is a smoker. His chest x-ray shows mediastinal lymphadenopathy and right-sided pleural effusion. CT scan shows irregular pleural thickening.** **√ The likely Dx → Mesothelioma.** **√ The likely cause → Asbestos. "**80% of mesothelioma are due to asbestos**".** **√ If he dies → refer to a coroner.**
Key 4	**Atelectasis**

Atelectasis is a common **postoperative complication** in which basal alveolar collapse can lead to respiratory difficulty. It is caused when airways become obstructed by bronchial secretions.

Features

It should be suspected in the presentation of **dyspnoea, tachycardia ± ↑ Temp.** and **hypoxaemia within 72 hours** postoperatively

Management → **chest physiotherapy**

Key 5

Pneumothorax

Pneumo = Air

♦ Acute respiratory distress "Tachypnea, Desaturation".

♦ ↑ Jugular venous pressure (Distended neck veins).

♦ On percussion over the affected side → Hyperresonance "air".

♦ ↓ BP (Hypotension) "**not always**".

♦ ↓ Air entry – no or diminished breath sounds – on the affected side.

♦ Trachea/ Mediastinum deviation to the "**OPPOSITE**" side (commonly in **Tension** pneumothorax). "This feature is not always present".

√ [Note that, **distended neck veins** and **shifted trachea** are seen more in "**Tension**" pneumothorax than in "Simple" pneumothorax].

√ Note that "Tension" pneumothorax may occur after thoracic trauma.

√ One of the most common causes of tension pneumothorax is **mechanical ventilation** in patients with pleural injury. One should suspect it if a patient on mechanical ventilation suddenly deteriorates and develops low O_2 saturation and hypotension. Imp √

Management of Tension Pneumothorax:

Do not wait for Chest X ray if the patient is severely distressed or the clinical diagnosis is certain. Give ***High O2*** *√* ***initially*** *and begin with:*

1) → Needle Decompression (Needle Thoracocentesis):

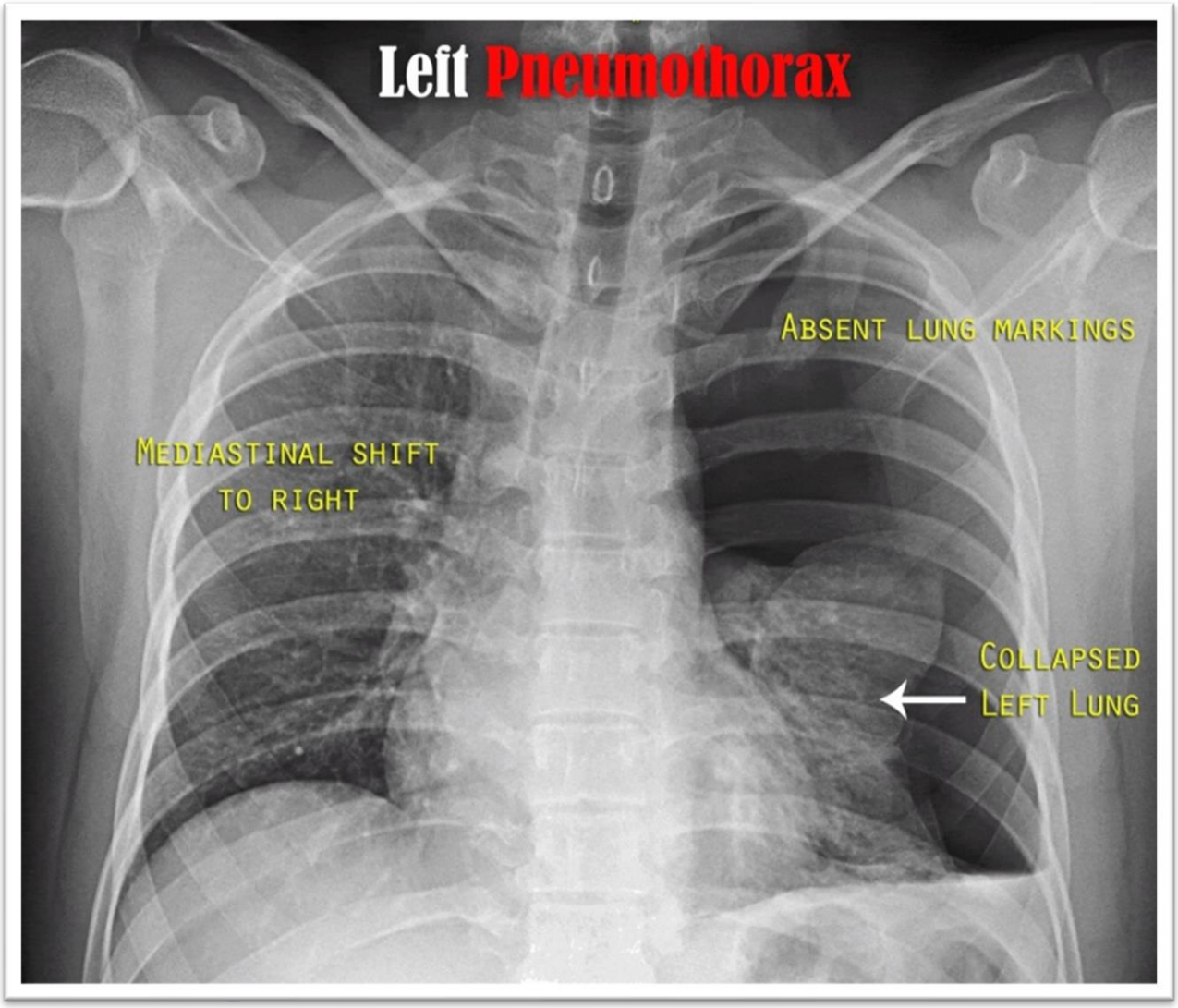
(Insert a large-bore cannula into the 5th intercostal space midaxillary line on the affected side. You can hear a hiss sound due to air escaping, which confirms the diagnosis and relieves the patient. The previous method was to insert the cannula into the 2nd intercostal space in the mid-clavicular line on the "affected side". However, the new ATLS guidelines now uses 5th intercostal space).

Then "after air has been aspirated and the patient has become less distressed"

2) → Insert a chest drain in 5th intercostal space anterior to mid-axillary line.

So, needle thoracocentesis is used first as a rapid treatment to buy time until a more definitive treatment (chest drain) is put in place.

If the patient is stable with good O2 saturation, the 1st investigation would be → **Chest X ray**.



Do not confuse it with **Cardiac Tamponade**:

Cardiac Tamponade → **Beck's Triad** →

Hypotension, **Muffled Heart Sounds**, **High JVP (Distended neck veins)**.

N.B. Chest X-ray that shows **enlarged globular heart** →

either Pericardial effusion (OR) Cardiac Tamponade.

- Dx: **Echo** is diagnostic
- Tx: **Urgent pericardiocentesis**.

Additional important notes on Pneumothorax

◘ Primary Spontaneous Pneumothorax:

→ Occurs spontaneously without a previous lung disease.

→ Mostly affects **Tall Then Young Males** (**hints**) with no apparent reason.

◙ "Please, consider **primary spontaneous pneumothorax** in any tall, thin, male who presents with increasing dyspnea, chest pain"

◙ Sometimes, acute severe asthma may have an underlying pneumothorax.

◙ For initial Diagnosis → **Erect Chest X-ray** "if the patient is not severely distressed" Otherwise, we proceed immediately to **needle decompression**.

◘ Secondary Spontaneous Pneumothorax:

→ Occurs spontaneously in the presence of an underlying lung disease

Such as **asthma** or **Chronic Obstructive Pulmonary Disease** (e.g. Hx of Chronic Smoking).

Important,

the initial management in the presence of underlying lung disease e.g., asthma, COPD:

◙ if the pneumothorax is (≤ 2 cm air rim i.e. ≤ 50%) → **Aspirate "insert Cannula"**

◙ if the pneumothorax is large (> 2 cm air rim i.e. > 50%) → **"Insert Chest Drain"**

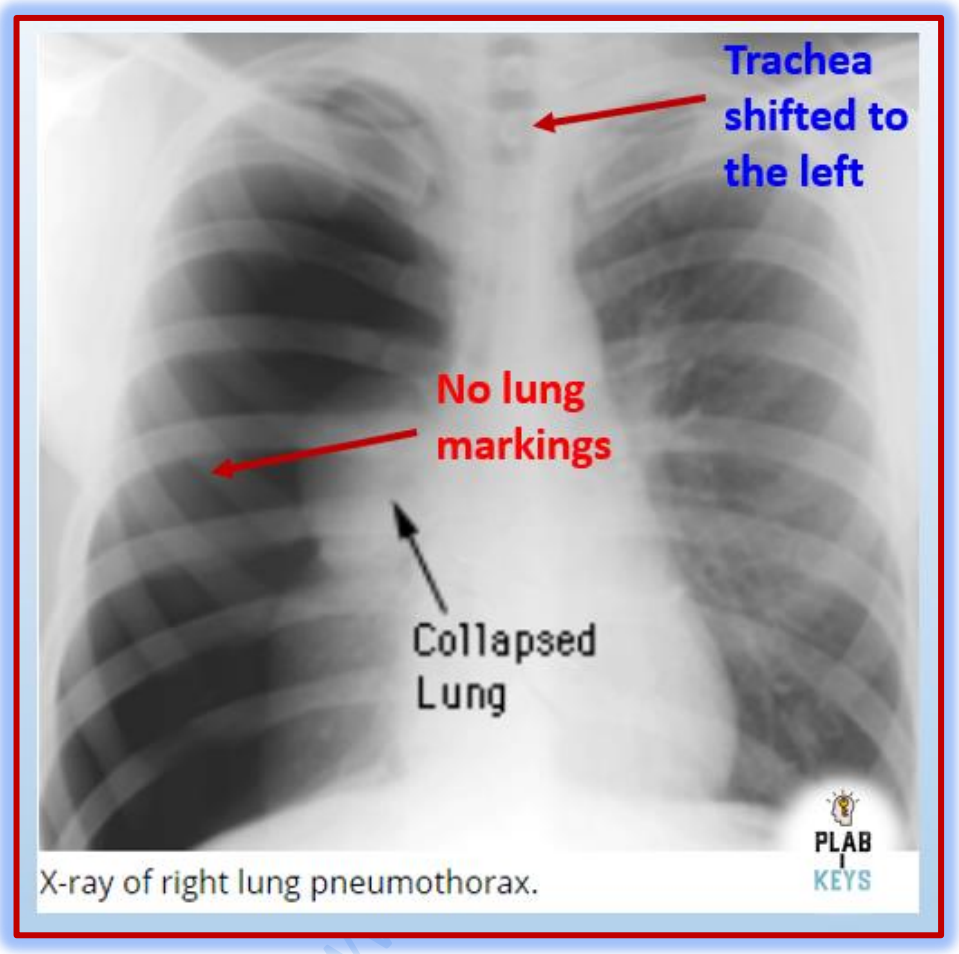
◘ Traumatic Pneumothorax

Examples, post- car accident, after receiving a stab on the back, post-interventional radiology into chest -e.g. CT guided biopsy to a mass in chest)

→ usually **tension pneumothorax**

→ **insert cannula (large-bore) to the second intercostal space at the midclavicular line on the affected side (Needle decompression)**.

♣ Sometimes, a stem would give a case of desaturating patient and Hx of smoking or COPD but instead of giving you the other features (such as shifted trachea), it would give you an apparent Chest X-ray:



X-ray of right lung pneumothorax.

Important Notes:

√ Remember, if the stem mentions "muffled heart sounds" along with hypotension and engorged "distended" neck veins,

→ think of **Cardiac Tamponade, and Pericardiocentesis is needed.** In the absence of muffled heart sound in a stem, the answer is most likely **not** Cardiac Tamponade.

	√ Otherwise, consider **Pneumothorax** "post-traumatic is usually **tension** type" especially in the presence of "decreased air entry over one side -the affected side-, tachypnea, tachycardia, hypotension". Note that Trachea is NOT always shifted. In such a patient, "**urgent needle decompression**" is needed. √ Remember, in "**hemothorax**, there is no engorged neck veins"

Key 6

Community Acquired Pneumonia (Mild)	**Amoxicillin**
Community Acquired Pneumonia (Moderate)	**Amoxicillin + Clarithromycin**
Community Acquired Pneumonia (Severe)	**Co-amoxiclav + Clarithromycin** Co-amoxiclav = Amoxicillin + clavulanic acid e.g. Augmentin®
Pneumocystis Jirovecii "P. Carinii"	**Co-Trimoxazole "important"** = (Trimethoprim + Sulfamethoxazole) = Bactrim®

What if the patient is severely allergic to penicillin and is on statins?

√ "**Severely**" Allergic to penicillin → Do not give amoxicillin/ Co-amoxiclav.

√ Cephalosporins "e.g. Cefuroxime" should also be avoided if there is a "**severe**" sensitivity to penicillin "10% cross-reactivity".

√ Clarithromycin should not be given if the patient is on Statins" Risk of Rhabdomyolysis".

So, what can be given in such a case?

→ **Doxycycline**.

For your knowledge,

In every 10 patients who are allergic to penicillin, 1 would be allergic to cephalosporin "10% Cross-reactivity". Therefore, we should avoid cephalosporin if the patient is severely allergic to penicillin (e.g. life-threatening anaphylaxis) but we may use cephalosporins if the allergy is mild.

Key 7

Sarcoidosis

Sarcoidosis is a multisystem disorder of unknown aetiology characterised by non-caseating granulomas. It is more common in young adults and in people of African descent

Features

Erythema nodosum, (Tender, red nodules over shins).

Bilateral hilar lymphadenopathy, (the most common finding on Chest X ray)

Polyarthralgia

Hypercalcaemia, **Fever**.

Please, whenever you see 2 of these features, consider "Sarcoidosis".

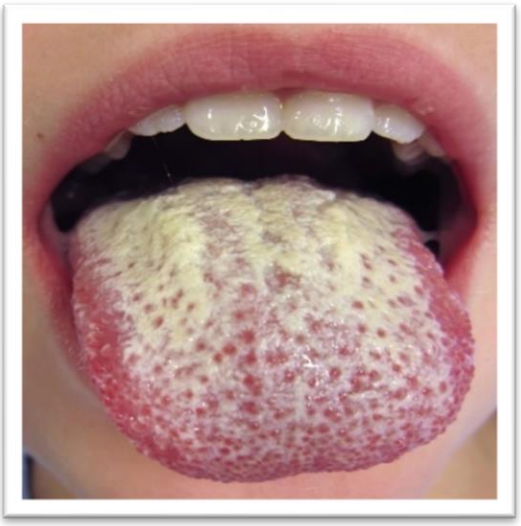
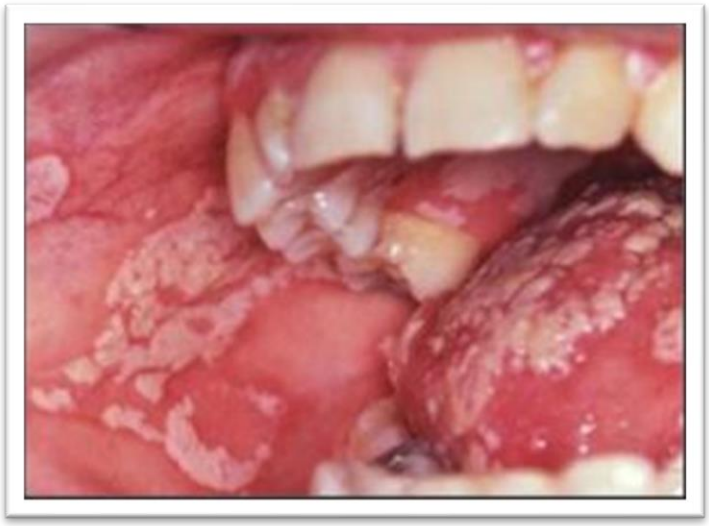
Syndromes associated with sarcoidosis

Lofgren's syndrome is an acute form o' the disease characterised by bilateral hilar lymphadenopathy (BHL), erythema nodosum, fever and polyarthralgia. It usually carries an excellent prognosis.

Heerfordt's syndrome (uveoparotid fever' there is parotid enlargement, fever and uveitis secondary to sarcoidosis.

Example,

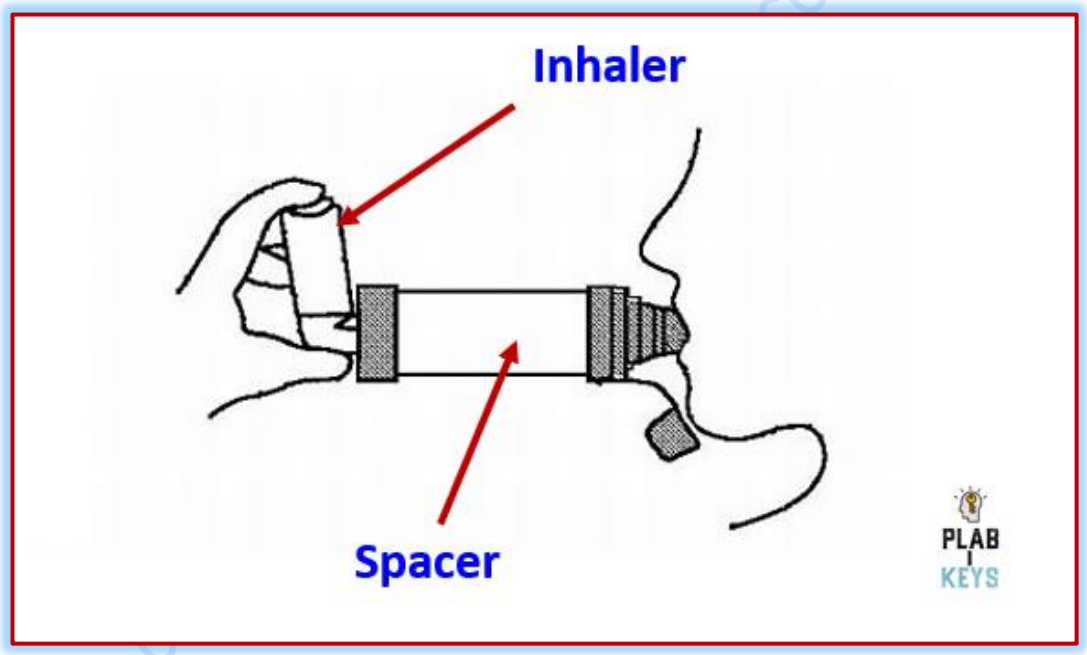
A 33 YO previously healthy female developed nodular rash over shins, pain and swelling on both knees and angles, mild fever.

	The likely Dx → **Sarcoidosis**. (Likely: **Lofgren's syndrome**) The most likely appearance on chest x ray → **Bilateral Hilar Lymphadenopathy**.
Key 8	◙ **Oral Thrush (Oral Candidiasis):**   - Hx of **immunosuppression**, **smoking,** Using oral or inhaled corticosteroids). - Thick white marks. - **Can be rubbed out.** **Treatment**: - Stop Smoking. - **Good inhaler techniques**, **spacer device**, **rinse mouth with water after use**. - **Oral Fluconazole 50 mg OD for 7 days.**

In those using Inhaled Steroids such as the asthmatics and the COPD patients, to avoid oral thrush "Oral Candidiasis":

√ Rinse mouth with "**water**" after use.

√ Check adequate **spacer** techniques.



Key 9

Long-term Steps of Management of Asthma

◘ **Step (1)**: **Inhaled SABA** (Short-acting beta-2 agonist e.g. **inhaled salbutamol**)

If asthma is not controlled (a patient uses inhaled salbutamol > 3 doses/ week) → Step 2

◘ **Step (2)**: **Inhaled SABA** + **Inhaled Corticosteroids** (e.g. **inhaled beclomethasone**)

◘ **Step (3)**: **Inhaled SABA** + **Inhaled Corticosteroids** + **LTRA** (**leukotriene receptor antagonist**).

◘ **Step (4)**: **SABA** + **Inhaled Corticosteroids** + **LABA** ± **LTRA**

LABA = Long-acting beta agonists e.g., **Salmeterol**, **Formoterol.**

Be careful,

the third step in NICE guidelines is LTRA "e.g., Montelukast" while

the third step in BTS guidelines is LABA "e.g., Salmeterol, Formoterol".

The question may include the guidelines.

◘ **Step (5)**: **SABA** + **Inhaled Corticosteroids** + **LABA** ± **LTRA** + **↑ dose of ICS**

√ ICS = Inhaled corticosteroids "e.g., beclomethasone"

√ Among the common **side effects** of **Inhaled Corticosteroids** (**Beclomethasone**)

→ **Oral/ Pharyngeal Candidiasis**, **Sore Throat**, **Dry mouth and throat**.

Long-Term Asthma Management in short (Recent)

1) **SABA**

2) **Still? → SABA + Inhaled Corticosteroids (Beclomethasone)**

3) **Still? → SABA + Inhaled Corticosteroids + LTRA**

4) **Still? → SABA + Inhaled Corticosteroids + LABA ± LTRA**

So, be careful, the third step in NICE guidelines is LTRA "e.g., Montelukast" while the third step in (BTS guidelines is LABA "e.g., Salmeterol".

The question may include the guidelines name. "*previously asked √*"

5) **SABA** + Maintenance and reliever therapy (**MART**) "**low-dose** inhaled corticosteroids (ICS)" ± LTRA

6) **SABA** + Maintenance and reliever therapy (**MART**) "**moderate-dose** inhaled corticosteroids (ICS)" ± LTRA

7) **SABA** ± LTRA (+) **One of the following**:

- ***Further increase the dose of inhaled corticosteroids*** (or)
- ***Trial of a new drug*** (e.g. ***theophylline***) (or)
- ***Seek professional advice***

Note that after SABA + ICS + LABA → **↑ Dose of Inhaled Corticosteroids**

Notes:

- **SABA** → **S**hort-**a**cting **B**2 **A**gonist → inhaled salbutamol
- **Inhaled corticosteroid** → **Inhaled beclomethasone**
- **LTRA** → **L**euko**t**riene **r**eceptor **a**ntagonist
- **LABA** → **L**ong-**a**cting **B**2 **A**gonist → Inhaled Salmeterol, Formoterol.

Important note,

In exercise induced asthma:

1) **SABA** "inhaled salbutamol"

2) **still**? → **SABA** + **Inhaled Corticosteroids** "inhaled beclomethasone"

3) **Still**? → **SABA** + **Inhaled Corticosteroids** + **Either**:

√ LTRA (e.g., montelukast) "preferred" **OR:**

√ LABA OR Sodium Cromoglicate.

◙ What is asthma?

A chronic inflammatory disorder of the airways secondary to type 1 hypersensitivity. The symptoms are variable and recurring and manifest as reversible bronchospasm resulting in airway obstruction.

"**Paroxysmal and Reversible obstruction of the airways**"

◙ Risk factors and aetiology

√ Personal or family history of **atopy**

√ Antenatal factors: maternal smoking, viral infection during pregnancy (especially RSV)

√ Low birth weight

√ Not being breastfed

√ Maternal smoking around child

√ Exposure to high concentrations of **allergens** (e.g. house dust mite)

air pollution

√ Socio-economic deprivation

◙ **Focusing on atopy**, patients with asthma also suffer from other IgE-mediated atopic conditions such as:

atopic dermatitis (**eczema**)

allergic rhinitis (**hay fever**)

◙ A number of patients with asthma are sensitive to **aspirin**. Patients who are most sensitive to asthma often suffer from nasal polyps.

◙ Drugs that aggravates Asthma:

BAN → Beta-blockers ▌Aspirin ▌NSAIDs.

◙ Symptoms and Signs of Asthma:

Symptoms:

- Cough: **often worse at night**, **early morning**.
- Dyspnoea.
- Wheezes.
- Chest tightness.

Signs

- Expiratory wheeze on auscultation
- Reduced peak expiratory flow rate (PEFR)

♣ In a stem, think of asthma if the symptoms are **worse at night** or **early morning**.

♣ Also, think of Asthma if the symptoms are worse after exposure to some **triggers** (eg, **pollen**, **pets**, **cold air**, **perfumes**) or after taking (Beta-blockers, Aspirin).

♣ Also, think of Asthma in the presence of **Atopy** (eg, eczema, hay fever).

♣ Also, think of Asthma if (FEV1/FVC) < 70% (<0.7) and **significantly improves** after giving bronchodilators. (**Reversible obstruction; improve post-bronchodilation) whereas in COPD, it remains < 0.7 even post-bronchodilation.**

Diagnosis of Asthma:

• Mostly Clinically:

• Others → **Spirometry**. (First).

Spirometry in asthma would show obstructive pattern (ie, FEV1/FVC ratio is **< 70%**).

After the patient takes a bronchodilator, FEV1 would improve by > **12%**.

• Important and asked previously: if a spirometry is given in the stem and it is normal but you still suspect asthma (eg, the patient has atopy and family history of asthma and he is clinically asthmatic) → **Peak flow diary**.

In the exam, if you suspect asthma, pick the investigation → **Spirometry.**

If spirometry is normal and asthma is still suspected → **Peak flow diary**.

IMPORTANT

◙ To help establish the Dx of Asthma → Spirometry.

◙ After establishing a Dx of Asthma, to help determine the appropriate time for the use of bronchodilators → Peak Flow Rate Diary.

Spirometry is a test which measures the amount (volume) and speed (flow) of air during exhalation and inhalation. It is helpful in categorising respiratory disorders as either obstructive (conditions where there is obstruction to airflow, for example due to bronchoconstriction in asthma) or restrictive (where there is restriction to the lungs, for example lung fibrosis). Key metrics include:

FEV1: forced expiratory volume – volume that has been exhaled–at the end of the first second of forced expiration

FVC: forced vital capacity – volume that has been exhaled–after a maximal expiration following a full inspiration

Typical results in asthma

FEV1: significantly reduced

FVC: Normal

FEV1% (FEV1/FVC): <7.0 (**but it is reversible; ie, improves post-bronchodilation) whereas in COPD, it remains < 0.7 even post-bronchodilation.**

	◙ **Beta-blockers** (e.g. **Atenolol**) important side effect → **Bronchoconstriction**. ◙ **Beta-Agonist** (e.g. **Salbutamol**) important side effect → **Tachycardia**. --- **Scenario** A 29 YO patient presents to the ED with wheezes and shortness of breath. He is an asthmatic and hypertensive and his GP has recently changed his medication. The likely causative medication is → **Beta-blocker (e.g. Atenolol)** ◙ **Drugs that aggravates Asthma:** **BAN** → Beta-blockers ▌Aspirin ▌NSAIDs.
Key 10	**√** Productive cough. **√ Fever**. **√** Chest tightness. **√** Unilateral Basal Crackles (on Auscultation.) **√** Unilateral Lobar Consolidation (on X-ray). **√** High WBCs, CRP "Sometimes, chest pain that ↑ with inspiration -pleuritic chest pain- "

	→ **Pneumonia** [**Important**] If pneumonia does not improve with antibiotics **±** there are night sweating, weight loss or new pleural effusion → think of **Empyema** → Perform **Pleural Aspiration**. Note that "**Pleural Aspiration**" is an investigation -sent for culture and microscopy-, whereas "**Chest drain**" is a treatment in case of compromising pleural effusion and confirmed empyema. **Empyema** is defined as pus collection in the pleural space. It typically is a complication of pneumonia. However, it can also arise from other causes such as penetrating chest trauma, esophogeal rupture, complication from lung surgery, or inoculation of the pleural cavity after thoracentesis or chest tube placement. ***Pneumonia with many examples are explained in the Infectious disease chapter.***
Key 11	[**Important**]

Small cell lung cancer → **SIADH** "Syndrome of inappropriate antidiuretic hormone"

SIADH → **Low serum sodium**, **Low Serum Osmolality**, **High Urine Osmolality**.

Mnemonic: **S**IADH = **S**odium **and** **S**erum are ↓

Remember:

- **Small cell cancer of the lung → SIADH & Cushing.**
- **SCC of the lung → Hypercalcemia.**

Also, remember:

♦ SIADH: Hypo**n**atremia, Low **S**erum Osmolality, High Urine Osmolality.

♦ Diabetes insipidus (DI): Hyp**er**natremia, Low **U**rine Osmolality, High Serum Osmolality. ***(This low urine osmolality in DI increases after giving vasopressin)***

Squamous Cell Carcinoma histopathology:

	→ Large Polygonal Cells with Keratin Pearls and Bridges
Key 12	Patients with late stages of terminal diseases should be sent to **palliative care** nurse for end of life care.
Key 13	◙ **Beta-blockers** (e.g. **Atenolol**) important side effect → **Bronchoconstriction**. ◙ **Beta-Agonist** (e.g. **Salbutamol**) important side effect → **Tachycardia**. **Example**, A29 YO ♀ presents to the ED with tachycardia, palpitation and chest pain. She is an asthmatic and is on several medications and inhalers for her asthma. → **Review her medication** (she is asthmatic and salbutamol which is a short-acting-beta2 agonist is known to cause Tachycardia and Palpitation).
Key 14	**Chronic Obstructive Pulmonary Disease (COPD)** **√** One of the most common diagnoses encountered in medical practice. **√** COPD is an umbrella term encompassing the older terms **chronic bronchitis and emphysema**. **√** In the **vast majority** of cases, COPD is caused by **smoking**.

√ Some patients with more mild disease may just need to use a bronchodilator occasionally whereas other patients may have several hospital admissions a year secondary to infective exacerbations.

Features (COPD)

♦ Hx of Smoking "in the majority of patients".

♦ Progressive Dyspnea "= breathlessness = shortness of breath".

♦ On spirometry → FEV1/FVC ratio is <0.7 (and it will remain <0.7 even after giving bronchodilation – COPD → irreversible airflow obstruction).

"If this ratio becomes >0.7 post-dilation, this may indicate other condition e.g. asthma".

♦ Others → cough: often **productive**, wheeze, **Hyperinflated chest on CXR**.

♦ In severe cases, right-sided heart failure may develop resulting in peripheral oedema

NOTE,

Noisy breathing, **hoarseness of voice** can be seen due to chronic **smoking**.

Investigations (COPD):

◘ Post-bronchodilator **spirometry** to demonstrate airflow obstruction:

√ FEV1/FVC ratio less than 70% (<0.7),

√ FEV1 is < 80% predicted,

√ Increased Residual Volume (↑ RV) due to air trapping "important"

◘ **Chest X-ray**: **hyperinflation**, bullae, **flat hemidiaphragm**, >7 posterior ribs seen.

◘ Full blood count: exclude secondary polycythaemia

body mass index (BMI) calculation

Important Points:

♦ On spirometry of COPD → FEV1/FVC ratio is <0.7 (and it will remain <0.7 even after giving bronchodilation because COPD is → **irreversible** airflow obstruction). **"very mild, unremarkable improvement might be seen sometimes but the ratio will remain < 0.7"**

Example,

FEV1/FVC ratio = 2.4/3.7 = 0.65 (<0.7)

After giving a bronchodilator (eg, inhaled salbutamol):

FEV1/FVC ratio = 2.5/3.7 = 0.67 (very mild improvement but still <0.7)

→ **It is COPD "or chronic bronchitis" but not Asthma**!

Important Note,

Remember that Chronic bronchitis is one form of COPD. Thus, the answer sometimes is "Chronic bronchitis" if COPD is not given in the options.

√ **Chronic bronchitis** is defined as a productive cough that lasts for three months.

√ **Other features** → Progressive dyspnea, Wheezes, ± low grade fever.

√ Many people with chronic bronchitis have chronic obstructive pulmonary disease (COPD.

√ **Tobacco smoking** is the most common cause.

Important point:

♦ If a smoker with symptoms of breathlessness and chest tightness that **WORSE at night** and **early morning** → Think of **Asthma** Especially in the presence of Hx of **Atopy** (e.g. **Eczema**).

◙ Management of COPD

(◘) **In stable Cases**,

√ Stop smoking,

√ Short -acting beta2-agonist (SABA) or short-acting muscarinic antagonist (SAMA) is first-line treatment.

	√ Add a long-acting beta2-agonist (LABA) + long-acting muscarinic antagonist (LAMA). √ If there are asthmatic features suggesting steroid responsiveness: LABA + inhaled corticosteroid (ICS). √ If patients remain breathless or have exacerbations offer triple therapy i.e. LAMA + LABA + ICS NICE recommend the use of combined inhalers where possible. √ Oral theophylline. NICE only recommends theophylline after trials of short and long-acting bronchodilators or to people who cannot used inhaled therapy. (◘) **Assess** the need for LTOT "**Long-Term O2 Therapy**" if any of the following: √ Very severe airflow obstruction (FEV1 **< 30%** predicted). √ Oxygen saturations **less than or equal to 92% on room air**. √ Cyanosis. √ Polycythaemia. √ Peripheral oedema. √ Raised jugular venous pressure. (◘) **Offer** LTOT "**Long-Term O2 Therapy**" if any of the following: √ If **PaO2 <7.3** (normal: 10-14 kPa). **Or**

√ If **PaO2 7.3 – 8.0** (normal: 10-14 kPa) + **one** of the following:

Pulmonary hypertension / Secondary polycythemia / Peripheral edema.

◙ So, if a COPD patient present with (FEV1 **< 30%** predicted) ± oxygen saturations **less than or equal to 92% on room air**.

→ **Assess for long-term O2 therapy**.

◙ If already on Long-term O2 therapy but still breathless

→ **Prednisolone** or **Nebulised Normal Saline** **"to loosen secretions".**

Patients who receive LTOT should breathe supplementary oxygen for at least 15 hours a day.

Points on the Management of COPD Exacerbation "imp"

- 24% - 28% Oxygen (not 100%) using "venturi face mask".
- Maintain O2 saturation between 88-92%.
- Nebulised salbutamol (with ipratropium bromide).
- Corticosteroids: 100 mg IV hydrocortisone or 30 mg prednisolone stat. (prednisolone should be continued as 30 mg OD for 7-14 days).
- Still no response? → IV aminophylline. (Rarely used now, so avoid picking it as an answer in the exam. Move to NIV -non-invasive ventilation-).

• If purulent sputum, fever, high CRP → give Antibiotics.

• After giving all these medical options, if he is still dyspnoeic, with impaired blood gas showing respiratory acidosis (low Ph, high PaCO2):

→ Non-Invasive Ventilation (NIV).

NICE recommends non-invasive ventilation (NIV) in patients with COPD exacerbation especially if Ph is 7.25-7.35 (respiratory acidosis).

• If NIV failed or there is impaired mental status, respiratory arrest, high aspiration risk → Intubate and ventilate (invasive ventilation).

• One alternative valid answer is → Shift patient to ICU (intensive care unit).

• One important indication for intubation: GCS ≤ 8.

◙ **Scenario (1):**

A 60 YO man with Hx of chronic obstructive pulmonary disease is brough to the ER complaining of sudden onset of shortness of breath. He is using his accessory muscles to breathe and there is bilateral wheezing. His RR is 29 and O2 is 80%. He was immediately started on oxygen with FiO2 24% via venturi mask. He was given salbutamol with ipratropium and 100mg IV hydrocortisone. Chest X-ray shows bilaterally hyperinflated lungs.

After this initial treatment, his ABG shows low Ph (7.32) and high paCO2.

Q) What is the most appropriate next step in management?

→ **Non-invasive ventilation**.

*The **Global Initiative for Chronic Obstructive Lung Disease (GOLD)** no longer recommends the routine use of **aminophylline** due to its limited efficacy and higher risk profile.*

He still has respiratory acidosis after the medical treatment + Low O2 sat +

There are no indications for invasive ventilation (intubation) such as impaired mental status, respiratory arrest. So, we go for the next step first. The next steps: → non-invasive ventilation (NIV). If failed → Intubation.

Q) The patient in scenario (1) was started on non-invasive ventilation (NIV). However, his O2 saturation is still low, and his GCS has become 8.

Next step? → **Shift patient to ICU = Intubate and ventilate**.

◙ **Scenario (2)**:

A 60 YO man with a history of chronic obstructive pulmonary disease is brough to the ER complaining of difficulty breathing and **confusion**. His breath sounds are **quiet**. His GCS is 11/15. His **RR is 9** and O2 is 80%. He was immediately started on oxygen with FiO2 40% via venturi mask.

His ABG shows low Ph and high paCO2.

What is the most appropriate next step in management?

→ **Intubate and ventilate (invasive ventilation)**.

	His RR is 9 and his breath sounds are quiet → going to respiratory arrest. *Also, his mental status is impaired.* *Therefore, the valid answer is intubation and ventilation.* ◙ **Scenario (3)**: A 55-year-old man with a history of COPD presents to the ER with wide chest wheezes and breathlessness. He is afebrile. His pulse rate is 114 bpm, BP is 128/82 mmHg, respiratory rate is 28 breaths/minute and O_2 saturation is 85%. He is started on 24% oxygen by Venturi face mask. What is the most appropriate NEXT step in the management? → **Salbutamol nebulizers**.
Key 15	**Remember**, Persistent cough + Copious purulent Sputum + Tram trac opacities → **Bronchiectasis**. ◙ **To confirm the Dx** → **High resolution CT scan (HRCT). "important"**

Key 16

Management of Acute Asthma Exacerbation in Pediatrics

1 ♦ **Oxygen**.

2 ♦ **Salbutamol** Nebuliser (could be given back-to-back).

3 ♦ Add **Ipratropium Bromide** Nebuliser.

*"**Salbutamol** and **Ipratropium** can be mixed in a solution and repeated)*

4 ♦ **Corticosteroids**.

√ **Oral prednisolone** (either liquid or crushed tablets dissolved in water)

√ OR **IV hydrocortisone**.

5 ♦ **If still in asthma exacerbation, consider: "*important*"**

♠ **IV Magnesium sulphate (MgSO4):** *tried **first** before the following 2 options*.

♠ **IV** Salbutamol

♠ **IV** Aminophylline (unlikely to be the correct answer as it is given by seniors in severe life-threatening asthma exacerbations that have failed to respond to the max doses of bronchodilators and steroids). Also, *the **Global Initiative for Chronic Obstructive Lung Disease (GOLD)** no longer recommends the routine use of **aminophylline** due to its limited efficacy and higher risk profile.*

♠ **Non-invasive ventilation (NIV):** used if the above have been tried but still symptomatic or acidotic.

◙ **Once there is a Silent chest, GCS <8** → Intubate.

Salbutamol is a short-acting beta$_2$ agonist (SABA).

Ipratropium bromide is anticholinergic.

After giving O2, Salbutamol…etc, if the child develops tachypnea, SOP, drowsiness

Request → **Arterial blood gas**.

(To look for respiratory acidosis and manage accordingly).

Management of Acute Asthma Exacerbation in Adults

1 ♦ **O2**

2 ♦ **Salbutamol** 5 mg (or terbutaline nebulised with O2)

3 ♦ **Corticosteroids**

√ **100 mg IV hydrocortisone**. (**√**) if not available, give:

√ **Oral prednisolone** (40-50 mg PO) (**√**)

If Severe/ Life-threatening/ Non-improving:

4 ♦ Give **Salbutamol nebulizers** back-to-back every 15 minutes and **Add Ipratropium Bromide** **0.5 mg** to the Nebulisers.

5 ♦ **Single dose of Magnesium Sulphate (MgSO4)** **1.2-2 g IV over 20 minutes.**

If the patient is improving, give salbutamol nebulizer every 4 hours and prednisolone 40-50 mg PO OD for 5 days.

◙ If **no response**, and or **impending respiratory failure**

→ **Admit to intensive care unit (ICU), for possible mechanical ventilation**.

◙ If **Silent chest** → **Intubate**. √

Important: What if no improvements, and **SILENT Chest** develops?

→ **Intubation**. √

Remember, some uses of MgSO4:

√ Eclampsia "seizures".

√ Polymorphic (Broad-Complex) Ventricular Tachycardia

= Torsades De Pointes (TDP)

√ Refractory Asthma exacerbation that does not respond to Salbutamol, Hydrocortisone, Ipratropium bromide.

Key 17

Squamous Cell Carcinoma of the lung histopathology:

→ Large Polygonal Cells with Keratin Pearls and Intracellular Bridges

	√ SCC is more common in smokers while Lung Adenocarcinoma is more seen in non-smokers. √ SCC is usually present Centrally.
Key 18	It is Very difficult to differentiate the types of pneumonia clinically. However, try to memorise the next links as they usually (but not always) work and sometimes are given as hints: • Pneumonia developed **after influenza** (**Flu**) → **Staph**. **Aureus**. (50% bilateral). • **Herpes Labialis** → **StreptococcaL** (Pneumococcal). • **Erythema Multiforme** → **Mycoplasma** • **Atypical features: young adult, dry cough, bilateral consolidation** → **Mycoplasma** • **HIV** with **CD4 < 200 ± desaturation on exercise** → **Pneumocystis Jirovecii** (Carinii) • Pneumonia after Hx of **Exposure to Water + low Na^+ + Low lymphocyte, staying in a hotel** → **Legionella**

Rx √→ give Macrolides (eg, **Clarithromycin**, Azithromycin) or tetracycline.

Atypical pneumonia (eg, caused by Mycoplasma, Legionella, Chlamydophila), tends to occur in closed communities as outbreaks (eg, military barracks, hotels, water pools). Atypical pneumonia tends to have a milder fever and to be less acute and severe than the typical bacterial pneumonia.

It is treated with → oral clarithromycin, or oral doxycycline, or oral erythromycin (in pregnancy).

Example, A 15 YO male presents with dry cough, target lesions on the dorsum of hands, X ray shows bilateral consolidations

→ target lesions → **erythema multiforme** → **Mycoplasma pneumonia**.

◙ In a suspected case of **pneumonia** (**fever**, **cough**, **dullness** on percussion),

The investigation is → **Chest X-ray**

◙ The follow-up investigation → **Chest X-ray**

To R/O malignancy, especially if he is smoker ± weight loss

Where should the medication received? Admission or Outpatient?

Note that in hospital, once blood tests are available the **CURB-65** can be used

Criterion	Marker
C	Confusion (abbreviated mental test score <= 8/10)
U	urea > 7 mmol/L
R	Respiration rate >= 30/min
B	Blood pressure: systolic ≤ 90 mmHg and/or diastolic ≤ 60 mmHg
65	Aged >= 65 years

NICE recommend, in conjunction with clinical judgement:

- consider **home-based care** for patients with a CURB-65 score of 0 or 1 – low risk (less than 3% mortality risk)
- consider **hospital-based care** for patients with a CURB-65 score of **2 or more** – intermediate risk (3-15% mortality risk)
- consider **intensive care assessment** for patients with a CURB65 score of **3 or more** – high risk (more than 15% mortality risk)

Example,

A 52 YO presents with productive cough for 12 days. He has SOB and fever of 38.9 C. His RR is 25, HR is 90 bpm, BP is 110/80. His Chest x ray shows right lower consolidation. His lab results are unremarkable. He has severe allergy to penicillin.

√ Firstly, **his CURB-65 score is Zero → can be managed at home**.

	√ Since he is **severely penicillin allergic** → No Amoxicillin or co-amoxiclav or cephalosporins such as cefuroxime. √ He is **not** on statins, so we can give Clarithromycin. The answer → **Discharge with oral Clarithromycin**. --- **In HIV-Positive patients, prophylaxis antibiotics might be needed:** √ If CD4 < 200 → **Co-trimoxazole** (prophylaxis against **Pneumocystis jirovecii**). √ If CD4 < 50 → **Azithromycin** (Prophylaxis against **Mycobacterium avium**).
Key 19	**Hx of smoking**, **Elderly**, **Chronic cough**, **Weight Loss** ± **Hemoptysis** ◙ → suspect **Lung Cancer** ◙ **Initial** investigation → **Chest X-ray**. √ ◙ To **confirm** the Dx → **Bronchoscopy** √ "To obtain histological and cytological specimens – biopsy".

Key 20

Criteria "features" for Life-threatening Asthma:

- **Altered mental status with drowsiness.**
- **Silent Chest.**
- **Poor respiratory effort.**
- **Exhaustion.**
- **Cyanosis.**
- **Arrhythmia.**
- **Hypotension.**
- **PEF < 33% predicted or best.**
- **SpO2 < 92%.**
- **PaO2 < 8 kPa.**
- **PaCO2 is normal (4.6-6 kPa)**

Key 21

Pulmonary Embolism Important Notes

• Low molecular weight heparin (LMWH) "e.g., enoxaparin" is ideally commenced post-op as a prophylaxis to prevent DVT and Pulmonary embolism.

• However, if a **post-operative** patient develops **Chest pain**, **Dyspnea** ± other features of Pulmonary embolism (e.g., tachycardia, tachypnea, hemoptysis),

→ ~~**LMWH dose shall be increased and CT pulmonary angiogram shall be done**~~.

Increase dose from a prophylaxis to a treatment dose (outdated). See below:

(Important update on Managing VTE):

• If one of these two **DOACs:** **"apixaban or rivaroxaban"** is within the options and the patient is not pregnant, pick it as these 2 have become the **first line** for venous thromboembolism (VTE); Pulmonary embolism (PE), Deep vein thrombosis (DVT) (**Initiated once PE is suspected or confirmed**).

• What if **a different DOAC** is in the options (not apixaban or rivaroxaban), (eg, **dabigatran**)? → Pick **low molecular weight heparin LMWH eg, enoxaparin**.

You can give LMWH for 5 days and then shift to dabigatran.

• What if the patient is **pregnant**? → pick **LMWH**. (Both warfarin and DOACs are contraindicated in pregnancy).

√ Note that if the patient is vitally stable, the CT pulmonary angiogram can be done as an **outpatient**.

√ "**D-Dimer**" will be high post-op, so it is not of much help to use it as an indication of PE post-op.

Hints to suspect Pulmonary Embolism (PE):

♦ Hx of **prolonged immobility** (e.g., after surgery, **long-travel by air**).

♦ Presence of **Risk Factors** for PE such as:

COCP, **Surgery**, **Obesity**, **Pregnancy**, **Malignancy**, **Previous venous thromboembolism**

♦ + One or more of:

√ **Shortness of breath** "Dyspnea".

√ **↑ respiratory rate**.

√ **Chest pain** "often pleuritic, retrosternal" .

√ **Hypoxia** (↓O_2 sat.) ± **Hypocapnia** (↓$paCO_2$), ↑pH → ie, respiratory alkalosis.

√ **Tachycardia**.

√ **Dizziness**.

√ Cough and **Hemoptysis**.

• The investigation of choice is → **CTPA "CT Pulmonary Angiography"** √

• **Important**: if the question asks about the "first" or "initial" imaging?

→ **Chest X-ray** (to rule out other causes eg, pneumonia, pneumothorax).

◙ Once pulmonary embolism is suspected or confirmed, **start 1 of these 2**

→ **Direct oral anticoagulants -DOACs- (apixaban or rivaroxaban)**.

If neither apixaban nor rivaroxaban is suitable or if not in the options, but a different DOAC (eg, dabigatran) is given in options → pick **LMWH**.

You can give LMWH for 5 days and then shift to dabigatran.

	◙ If the patient with PE is pregnant → **LMWH**. "Both warfarin and DOACs are contraindicated during pregnancy". Do not get confused, the **prophylactic** dose can be given after surgery if the patient is expected to stay immobile. However, once PE is suspected or confirmed, a **treatment** dose should be given.
Key 22	Suspecting **Pneumocystis jirovecii** (e.g. HIV patients) → Co-trimoxazole Suspecting **Legionella** (Water exposure/ Hotel/ Low Sodium) → Clarithromycin
Key 23	**Collection of (Gram +ve/ -ve) Organisms with treatment** Hx of travel + Diarrhea → Bloody Diarrhea, Fever, abdominal pain → Think of Traveller's diarrhea; **Campylobacter jejuni** "Gram -ve Bacilli" • Traveller's diarrhea main causes are **Salmonella** and **Campylobacter** jejuni.

• Both are **gram -ve bacilli** (rods).

• They are **self-limiting** but treatment is needed especially in **elderly** and those who are **immunocompromised**.

√ Salmonella first line → Ciprofloxacin.

√ Campylobacter first line → erythromycin or clarithromycin ▌2nd → Ciprofloxacin.

Streptococcus Pneumoniae

• **Gram POSITIVE Cocci**. "**diplococci**"

• The **commonest** cause of Pneumonia.

• **Typical Pneumonia features**:

√ Productive cough. **√** Fever. **√** Chest tightness.

√ Unilateral Basal Crackles (on Auscultation.)

√ Unilateral Lobar Consolidation (on X-ray).

√ Vey Important → Association with **Herpes Labialis**.

◙ Mild → Amoxicillin

◙ Moderate → Amoxicillin + Clarithromycin.

◙ Severe → Co-amoxiclav + Clarithromycin.

If severe allergy to Penicillin → Doxycycline

So, in a classical scenario of pneumonia, the most likely organism is

→ **Streptococcus pneumonia** (the most common cause of pneumonia).

♦ The most common causative organism of **UTI** → **E. coli** (Gram -ve)

- **Acute pyelonephritis → Urine Culture → Then Start Antibiotics.**
- **Upper UTI** → Ciprofloxacin (**or**) Co-amoxiclav.
- **Lower UTI** → Trimethoprim (**or**) Nitrofurantoin.

So,

√ Campylobacter means **Curved Bacilli** "rods". It is **Gram -ve** on stool culture and sensitivity.

√ So, **Campylobacter** → **Gram -ve Bacilli "rods"**.

	√ **V. Cholera** → **Gram -ve comma-shaped**. √ **Streptococcus pneumonia** → **Gram +ve Diplococci**. √ **Staphylococcal Aureus** → **Gram +ve** and **Coagulase +ve cocci "round"**
Key 24	**Remember,** **Horner's syndrome** ⟶ Unilateral ***Ptosis***, ***Miosis***, ***Anhidrosis*** Due to ⟶ **Compression of the Ipsilateral of Sympathetic Chain**. (e.g. in **Pancoast tumor**) • **Pancoast Tumour** → A tumour of the **Apex** **of the Lung** (present at the top end of either the left or the right lung). It typically spreads to the nearby tissues such as the ***Ribs,*** the ***Vertebrae, unilateral compression of sympathetic chain, causing Horner's syndrome***. Most Pancoast tumours are Non-small cell lung cancer. So, in an elderly who is **smoker** and present with **chest pain** (often pleuritic) + signs of Horner's (e.g. unilateral **miosis**, **ptosis**), suspect → **Lung cancer** (particularly: **Pancoast tumor**).
Key 25	**The Steps (Approach) to Determine the Type of the Blood Gas Abnormality. How to Diagnose ABG?** 1) Is the patient **acidaemic** (**pH <7.35**) or **alkalaemic** (**pH >7.45**)?

2) **Respiratory component**: What has happened to the **$PaCO_2$**?

- **$PaCO_2$ > 6.0** kPa suggests a **respiratory acidosis** (or respiratory compensation for a metabolic alkalosis).
- **$PaCO_2$ < 4.7** kPa suggests a **respiratory alkalosis** (or respiratory compensation for a metabolic acidosis).

3) **Metabolic component**: What is the **bicarbonate (HCO3)** level/base excess?

- **bicarbonate < 22** mmol/l (or a **base excess < - 2mmol**/l) suggests a **metabolic acidosis** (or renal compensation for a respiratory alkalosis)
- **bicarbonate > 26** mmol/l (**or a base excess > + 2mmol**/l) suggests a **metabolic alkalosis** (or renal compensation for a respiratory acidosis)

Simply, know that CO2 is an Acid, and Bicarbonate (HCO3) is an Alkali.

Example (1):

pH 7.17 (Normal: 7.35-7.45)

PCO2 2.5 (Normal: 4.7-6 kPa)

Base excess -14 (Normal -2 to +2)

→ **Metabolic acidosis** (with partial respiratory compensation).

♦ **As the pH < 7.35** → definitely Acidosis.

♦ **PCO2 (the acid) is low** → this is a compensation by the lungs; they try to breathe quickly to get rid of the CO2 (the acid) to buffer the acidity. The patient might present with tachypnea or SOB.

♦ **Base excess is very low** → metabolic acidosis.

Example (2):

An elderly man was found on the floor unconscious by his neighbours. The ambulance crew came. His Systolic BP was 65mmHg. He was resuscitated in the ambulances (given 1.5 L NaCl 0.9%). He was further resuscitated in the emergency department. He mentions that he had severe diarrhea over the last 2 days. His labs show:

pH 7.18 ▌Base excess -13 ▌Lactic acid 6 (high)

Urea and Creatinine are high ▌CRP 160 (high)

His blood gas interpretation → **Metabolic Acidosis**

As his Ph < 7.35 → Acidosis

His Base excess is very low (< -2) → Metabolic Acidosis.

This patient had profuse diarrhea for 2 days. Remember that profuse diarrhea can lead to loss of HCO3 "Bicarbonate" and thus metabolic acidosis.

Also, remember that profuse diarrhea can lead to → Hypovolemia "Dehydration", which is an important prerenal cause for AKI. That's why his renal functions are impaired.

Example (3):

A 28 YO has been having shortness of breath for the last 16 hours and is feeling unwell. His arterial blood gas show:

pH 7.51 ▌PaO2 8 (normal is > 10) ▌PaCO2 3.1 (Normal 4.6-6)

Bicarbonate 20 (normal 22-26).

The likely Dx → **Respiratory Alkalosis**

(SOB → ↑ RR → getting rid of CO2 which is an acid → resp. alkalosis)

Noe that:

Respiratory Alkalosis can be seen in **Pulmonary Embolism**

and **Panic attack**

However, the associated decrease in PaO2 "Hypoxia" suggests **PE**.

Important,

Respiratory Acidosis (pH <7.35):

Eg, → Asthma, COPD

Low or normal PaO2, High PaCO2 (>6), Bicarbonate is normal (22-26) or around it.

Respiratory Alkalosis (pH >7.45) in:

◙ Pulmonary Embolism:

Low PaO2 (<10), Low PaCO2 (<4.7), Bicarbonate is normal (22-26) or around it.

◙ In Panic attack, it is the same, but the PaO2 will be normal (>10):

Normal PaO2 (>10), Low PaCO2 (<4.7), Bicarbonate is normal (22-26) or around it.

Example (4):

A 31-year-old man presented to the ER with asthma exacerbation. After receiving 100% O_2 by a face mask, nebulized salbutamol, and oral prednisolone, ABG was done and it showed:

pH: 7.31 ▌PaO_2: 11 (normal is 10-14 kPa) ▌$PaCO_2$: 8 (Normal 4.7-6 kPa)

Bicarbonate (HCO3): 30 (normal 22-26 mmol/L).

Based on the ABG findings, what is the most likely diagnosis?

A) Metabolic acidosis with respiratory compensation.

B) Metabolic alkalosis with respiratory compensation.

C) Mixed acidosis.

D) Respiratory acidosis.

E) Respiratory alkalosis.

Answer → D.

- Since **pH is < 7.35** → It is Acidosis.
- Since **PCO2** is **high** → Respiratory (Lung are unable to clear the CO_2 -acid-).

→ A case of Respiratory Acidosis.

- Bicarbonate is high → Suggest renal compensation for respiratory acidosis.

There is no [Respiratory acidosis with renal compensation] in the options. Therefore, **respiratory acidosis** is the closest valid option.

Arterial Blood Causes

Metabolic Acidosis	• Drugs (**MAIIAD**): Metformin, Aspirin (Later on), Iron, Isoniazid, Alcohol, Digoxin. And Paracetamol (less common). • **Diarrhea**. • Renal insufficiency of any cause. • Addison's Disease
Metabolic Alkalosis	• Drugs: ACEi, NSAIDs (e.g. Diclofenac), Diuretic Therapy. • **Vomiting (due to the loss of gastric acid → Alkalosis)** • Hypovolemia, Hypokalemia. • 2ry Hypoparathyroidism.

	Respiratory Acidosis	• Any cause of airway obstruction **''apnea'' (Low RR).** • Drugs: Benzodiazepines, Organophosphates. • COPD, Asthma. • Pneumothorax, hemothorax, ascites. • N.B. If a patient is on a ventilator and developed respiratory acidosis → **Increase the ventilation** to washout the CO2 (The acid).
	Respiratory Alkalosis	ANY CAUSE OF **HYPERVENTILATION** (**High RR**) e.g. • PE (**Pulmonary Embolism**): Both PaO2 and PaCO2 are Low. (**Imp √**) • **Panic attack:** PaO2 is normal while PaCO2 is low. (**Imp √**) • Salicylate -**Aspirin**- (**early** in the course of poisoning). • Mechanical Ventilation (Rapid Ventilation).

Key 26	A 73 YO female presents with tiredness, cough, sputum production for 2 days. Her temperature is 39. While viewing her labs, you notice a slight increase in serum creatinine. What is the likely diagnosis? Bacterial Pneumonia √ Impaired renal function is irrelevant here.

	√ Cough, sputum, fever in (very old or very young) → think of pneumonia.
Key 27	Cough, SOB + Spirometry shows: FEV1/FVC ratio is <0.7 → Obstructive cause (e.g. Asthma or COPD) "if this ratio remains <0.7 post-dilation, this may indicate **COPD**". "if this ratio becomes >0.7 post-dilation, this may indicate **asthma**". FEV1/FVC ratio is >0.7 → Restrictive cause (e.g. **Pulmonary fibrosis**) imp √ **Features of Pulmonary Fibrosis:** √ √ Progressive exertional dyspnoea (SOB) √ Bi-basal fine end-inspiratory crepitations on auscultation √ Dry cough √ Clubbing A hint towards Pulmonary fibrosis → working in **Coal mines**. ♦ **Spirometry**: classically a restrictive picture: FEV1 → normal/decreased, FVC → decreased, FEV1/FVC → increased (>0.7) √

Key 28

Anticipatory Medications.

(**every single word is important**!)

♠ They are "**just in case**" medications that are allowed to be given to a patient during his/ her last days in life.

♠ They are only given **SUBCUTANEOUSLY**! "Important"

♠ **They are aimed at making the death more comfortable, and hence, they cover the following main possible complaints in a dying individual:**

- **Pain and Breathlessness** → SC Morphine.
- **Nausea and Vomiting** → SC Haloperidol.
- **Anxiety, Delirium, Agitation** → SC Midazolam.
- **Noisy Respiratory Secretions** → SC Hyoscine Butylbromide.

So, for a patient in hospice for end of life care who develops rattling throat noises and noisy breathing, give → **Hyoscine subcutaneously**.

Key 29

Hints → **Farmer**, **SOB and Cough**, **Diffuse micronodular shadowing**.

→ **Extrinsic allergic alveolitis**.

Extrinsic allergic alveolitis.

Extrinsic allergic alveolitis (EAA, also known as hypersensitivity pneumonitis) is a condition caused by hypersensitivity induced lung damage due to a variety of inhaled organic particles.

Examples

√ bird fanciers' lung: avian proteins

√ **Farme's** lung: spores of Saccharopolyspora rectivirgula (formerly Micropolyspora faeni)

√ malt workers' lung: Aspergillus clavatus

√ mushroom workers' lung: thermophilic actinomycetes*

Presentation

√ acute: occur 4-8 hrs after exposure, **SOB**, **dry cough**, **fever**

√ chronic

Investigation

chest x-ray: upper/mid-zone fibrosis → Diffuse Micronodular Interstitial Shadowing.

Bronchoalveolar lavage: lymphocytosis

	blood: NO eosinophilia
Key 30	**Lung cancer: paraneoplastic Syndrome features** **Small cell** • **SIADH** → Hyponatremia, Low Serum Sodium. • **ACTH** – not typical, hypertension, hyperglycaemia, hypokalaemia, alkalosis and muscle weakness are more common than buffalo hump. • **Lambert-Eaton syndrome**: the same presentation as Myasthenia gravis **but** with the following **differences**: √ The **reflexes are absent** and **elicited after exercise.** √ **↑ Strength/ power** of the weakened muscles **after repeated test.** **Squamous cell** • hypercalcaemia • parathyroid hormone-related protein (PTH-rp) secretion causing • clubbing • hypertrophic pulmonary osteoarthropathy (HPOA) • hyperthyroidism due to ectopic TSH

Key 31	Some Hints: ♦ **Builder**, **Shipyard worker** → Mesothelioma. ♦ **Farmer** → Extrinsic allergic alveolitis. ♦ **Coal mine worker** → Pulmonary fibrosis. "Coal worker pneumoconiosis"
Key 32	In the presence of pneumonia with other conditions such as bone pain, we need to treat pneumonia first (give antibiotics).
Key 33	Remember, in patients with **asthma**, we **avoid BAN**: ◙ **Drugs that aggravates Asthma:** **BAN** → Beta-blockers ▌Aspirin ▌NSAIDs. Thus, the most appropriate Analgesic is → **Paracetamol**.
Key 34	**A Woman had undergone hip replacement surgery. While in hospital, she developed Shortness of breath, tachycardia and chest pain.** ◙ The likely Dx → **Pulmonary Embolism**

	◙ The investigation of choice → **CT pulmonary angiogram**. ◙ Once pulmonary embolism is suspected or confirmed, **start 1 of these 2** → **Direct oral anticoagulants -DOACs- (apixaban or rivaroxaban)**. If neither apixaban nor rivaroxaban is suitable or if not in the options, but a different DOAC (eg, dabigatran) is given in options → pick **LMWH**. You can give LMWH for 5 days and then shift to dabigatran. ◙ If the patient with PE is pregnant → **LMWH**. "Both warfarin and DOACs are contraindicated during pregnancy".
Key 35	a COPD patient presents with (FEV1 **< 30%** predicted) ± ∨ oxygen saturations **less than or equal to 92% on room air**. → **Assess for long-term O2 therapy**.
Key 36	**A patient presents with sudden onset breathless. Previous Hx of panic attack ABG revealed respiratory alkalosis with hypoxia (Low PO2, Low HCO3, High Ph, Low PaCO2). What is the likely cause?** a) **Pulmonary embolism** b) Panic attack

c) Aspirin toxicity

Both **pulmonary embolism** and **panic attacks** can cause respiratory alkalosis. However, in **Pulmonary embolism**, both **PaO2** and **PaCO2** are **low**,

whereas in **Panic Attacks**, **PaO2** is **NORMAL** and **PaCO2** is **low**.

Note that aspirin toxicity presents with respiratory alkalosis early then it turns to metabolic acidosis. However, breathlessness without a Hx of pills intake draw us away from this option.

Respiratory Acidosis (Ph <7.35):

e.g. → Asthma, COPD

Low or normal PaO2, High PaCO2 (>6), Bicarbonate is normal (22-26) or around it.

Respiratory Alkalosis (Ph >7.45) in:

◙ Pulmonary Embolism:

Low PaO2 (<10), Low PaCO2 (<4.7), Bicarbonate is normal (22-26) or around it.

◙ In Panic attack, it is the same, but the PaO2 will be normal (>10):

Normal PaO2 (>10), Low PaCO2 (<4.7), Bicarbonate is normal (22-26) or around it

Ph > 7.45 → Alkalosis.

For More Clarification:

A 28 YO has been having shortness of breath for the last 16 hours and is feeling unwell. His arterial blood gas show:

Ph 7.51 ▌PaO2 8 (normal is > 10) ▌PaCO2 3.1 (Normal 4.6-6)

Bicarbonate 20 (normal 22-26).

The likely Dx → **Respiratory Alkalosis**

(SOB → ↑ RR → getting rid of CO2 which is an acid → resp. alkalosis)

Note that:

Respiratory Alkalosis can be seen in **Pulmonary Embolism**

and **Panic attack**

However, the associated decrease in PaO2 "Hypoxia" suggests **PE**.

Key 37	**What is the likely blood gas results in a patient with Asthma?** → **Respiratory Acidosis** (SOB, ↓ RR → Accumulation of the CO2, which is an acid → Resp. Acidosis)
Key 38	◙ **After removing a chest drain, a 40 YO man developed Tachypnea, Desaturation, Distended neck veins, Hypotension and ↓ Air entry on the right side** (Suspected traumatic pneumothorax, O2 was given) the next step: → **Needle decompression** **"Insert a large-bore cannula into the 2nd intercostal space in the mid-clavicular line on the "affected side"**
Key 39	**A 32 YO woman who is smoker complains of a history of wheezes and shortness of breath. She has Hx of eczema. Spirometry was done and showed a FEV1/FVC of < 0.7. However, there was a significant improvement of this ratio after receiving a bronchodilator.** The likely Dx → **Asthma**

	Careful: If the FEV1/FVC remained below 0.7 or showed minimal improvement after receiving bronchodilators → COPD. Eczema and Hx of allergy support asthma Dx.
Key 40	**A post-operative patient on low molecular weight heparin in hospital. He develops Chest pain, Dyspnea, Tachycardia and SOB.** → **↑ LMWH dose and order CT pulmonary angiogram**. Likely **Pulmonary Embolism**. √ Note that if the patient is vitally stable, the CT pulmonary angiogram can be done as an **outpatient**. **Important:** Recent guidelines advocate the use of **DOACs** instead of LMWH if the patient is not pregnant. Thus, DOAC is the right answer if both DOAC and LMWH are given in the options.
Key 41	A 24 YO presents with acute asthma exacerbation. Oxygen is given. What is the next step in management? → **Nebulised Salbutamol**.

Management of Acute Asthma Exacerbation in Adults

1 ♦ O2

2 ♦ Salbutamol 5 mg (or terbutaline nebulised with O2)

3 ♦ Corticosteroids

√ 100 mg IV hydrocortisone. (√) if not available, give:

√ Oral prednisolone (40-50 mg PO) (√)

If Severe/ Life-threatening/ Non-improving

4 ♦ Give Salbutamol nebulizers **back-to-back every 15 minutes** and Add Ipratropium Bromide **0.5 mg** to the Nebulisers.

5 ♦ Single dose of Magnesium Sulphate (MgSO4). **1.2-2 g IV over 20 minutes.**

If the patient is improving, give salbutamol nebulizer every 4 hours and prednisolone 40-50 mg PO OD for 5 days.

Key 42

◙ A young girl with SOB, wheezes, worsening cough, Hx of eczema. The most appropriate next diagnostic step is

	→ **Spirometry with bronchodilator reversibility**.
Key 43	A Smoker with chronic productive cough for 6 months, SOB, wheezes → **Bronchitis**. (or COPD if bronchitis is nol liven)
Key 44	**A 29-year-old female presents with sore throat. She has poorly controlled asthma. Her medications for asthma include beclomethasone, montelukast, salbutamol, salmeterol and Aminophylline. She developed white patch on the pharynx that dislodges easily. What is the cause of her sore throat?** a) Aminophylline b) **Beclomethasone** c) Salmeterol d) Salbutamol e) montelukast ◙ Among the common **side effects** of **Inhaled Corticosteroids** (**Beclomethasone**) → **Oral/ Pharyngeal Candidiasis**, **Sore Throat**, **Dry mouth and throat**. ◙ Among the common **side effects** of **SABA** (**Salbutamol**) → **Tachycardia**, **Palpitations**, **Tremors**, **Shaky hands**.

Key 45	◙ **COPD patient presents with:** FEV1 **< 30%** predicted **less than or equal to 92% on room air** **The next step →** **Assess of Long term O2 therapy**.
Key 46	◙ if a **post-operative** patient presents with **Chest pain**, **Dyspnea** ± other features of Pulmonary embolism (e.g. tachycardia, tachypnea, hemoptysis), → **Apixaban or Rivaroxaban**. If pregnant or not in the options → **LMWH**.
Key 47	◙ **The investigation of choice in pulmonary embolism is** → **CTPA "CT Pulmonary Angiography"**. • **Important**: if the question asks about the "first" or "initial" imaging? → **Chest X-ray** (to rule out other causes eg, pneumonia, pneumothorax).
Key 48	◙ After removing a chest drain, a 40 YO man developed Tachypnea, Desaturation, Distended neck veins, Hypotension and ↓ Air entry on the right side

	(Suspected traumatic pneumothorax, O2 was given) the next step: → **Needle decompression**. **"Insert a large-bore cannula into the 2nd intercostal space in the mid-clavicular line on the "affected side"**
Key 49	◙ A 33 YO previously healthy female developed nodular rash over shins, pain and swelling on both knees and angles and mild fever. The likely Dx → **Sarcoidosis**. (Likely: **Lofgren's syndrome**) The most likely appearance on chest x ray → **Bilateral Hilar Lymphadenopathy**. This nodular rash on skin is → **erythema nodosum**.
Key 50	**A 54 yr old man had a cardiac arrest and was successfully resuscitated following defibrillation. He was then admitted to ICU on ventilation.HR 120 bpm BP: 90/65mmHg.** **The following ABG values: Ph : 7.04 Po2: 12kpa Pco2: 9.5kPa, bicarbs: 19** **What is the most important immediate step?**

	A. Fluid challenge B. Increase fiO2 C. **Increase ventilation** D. Start ionotropes E. Start bicarbonate This patient with **cardiac arrest** developed → **MIXED ACIDOSIS** → (**Low Ph**, **High PaCO2**, **Low HCO3**) as he is not breathing (accumulation of CO2, and his kidneys do not perfuse due to low cardiac output). What to do? → **Increase ventilation**. (This will rapidly washout the CO2 which is Acid and help resolve the acidosis)
Key 51	**A 72 yr old woman developed sudden chest pain. She had surgery 6 days ago. What is the most likely diagnosis?** → **Pulmonary Embolism**
Key 52	**Criteria "features" for Life-threatening Asthma:** • **Altered mental status with drowsiness.** • **Silent Chest (Absent chest sounds)**

- **Poor respiratory effort.**
- **Exhaustion.**
- **Cyanosis.**
- **Arrhythmia.**
- **Hypotension.**
- **PEF < 33% predicted or best.**
- **SpO2 < 92%.**
- **PaO2 < 8 kPa.**
- **PaCO2 is normal (4.6-6 kPa). "Yes, when PaCO2 is normal in severe asthma exacerbation this is life-threatening as he is hyperventilated and paCO2 should be low). √**

Example (1)

A 3-year-old boy with asthma presents to the A&E with acute attack of wheeze. He is drowsy and has cold periphery. His HR is 180bpm, he has intercostal recession and widespread wheeze. What is the most significant feature that shows impending respiratory failure?

A. Cold periphery

B. **Drowsiness**

C. HR of 180bpm

D. Intercostal recession

E. Widespread wheeze

Example (2)

A 3-year-old boy with asthma presents to the A&E with acute attack of wheeze. He is cyanotic and has RR of 45. His HR is 180bpm, he has intercostal recession and widespread wheeze. What is the most significant feature that shows impending respiratory failure?

A. RR of 45

B. **Cyanosis**

C. HR of 180bpm

D. Intercostal recession

E. Widespread wheeze

Example (3):

A patient recently diagnosed of asthma which has been well controlled, now presents with increase respiratory rate, temp 36.7, auscultation reveals absent breath sound.

Which of the following will indicate life threatening asthma?

A. **Absent breath sound**

B. Increased respiratory rate

C. Intercoastal recession

Example (4)

A child with severe asthma exacerbation that he uses his accessory muscles presents with the following features. Which of them represents a life-threatening asthma?

A) PaO2 8.5 kPa. (Normal is: 10-14).

B) PaCO2 5.5 kPa (Normal is: 4.7-6).

C) pH 7.35 (normal: 7.35-7.45).

D) Heart rate of 105 beats per minute.

E) Oxygen saturation of 92%.

"Yes, when PaCO2 is normal in severe asthma exacerbation this is life-threatening as he is hyperventilated and using accessory muscles and thus paCO2 should be low).

Key 53	**An elderly woman had hip surgery and is on LMWH but developed sudden SOB and chest pain.**

A. **increase LMWH dose and arrange for CTPA**.

B. Continue on current dose and arrange CTPA.

C. Increase LMWH and arrange VQ scan.

D. Ct-scan of the chest.

E. DC cardioversion.

Key 54

Asthmatic patient who uses daily SABA inhalation for the last 4 months or so... Another drug to add. (EXACT Q FROM GMC WEBSITE SAMPLE Q).

a. **Inhalational steroids**

b. Add LABA

c. Sodium cromoglycate

Long-term Steps of Management of Asthma

- **Step (1)**: **Inhaled SABA** (Short-acting beta-2 agonist e.g. **inhaled salbutamol**)

If asthma is not controlled (a patient uses inhaled salbutamol > 3 doses/ week) → Step 2

- **Step (2)**: **Inhaled SABA** + **Inhaled Corticosteroids** (e.g. **inhaled beclomethasone**)

- **Step (3)**: **Inhaled SABA** + **Inhaled Corticosteroids** + **LTRA** (**leukotriene receptor antagonist**).

	◘ **Step (4)**: **SABA + Inhaled Corticosteroids + LABA ± LTRA** LABA = Long-acting beta agonists e.g. **Salmeterol, Formoterol**. ◘ **Step (5)**: **SABA + Inhaled Corticosteroids + LABA ± LTRA + ↑ dose of ICS** ICS = Inhaled corticosteroids "e.g. beclomethasone"
Key 55	**20yrs old stabbed at the right hemithorax. Bp 100/40 PR-140. Heart sound clearly heard. Hyperresonance percussion on the right. Trachea deviated to the left. Next action to be taken?** A. **Needle thoracentesis** B. Chest tube C. Intubate & ventilate D. Tracheostomy The features are suggestive of **Pneumothorax**.
Key 56	**54-year-old presented with productive cough. Sputum was initially yellowish and green, but occasionally with streaks of blood. She has a 20-pack year smoking history. She has coarse crepitations. X-ray showed patchy opacification. Dull percussion note at lower zone of right lung. There is weight loss. Vital signs are stable.**

What is the single most likely diagnosis?

A. Lung abscess

B. Bronchial CA

C. **bronchiectasis**

D. COPD

◙ **To confirm the Dx** → **High resolution CT scan (HRCT). "important"**

What are the signs and symptoms of bronchiectasis?

√ chronic daily cough.

√ **coughing up large amounts of thick mucus every day.**

√ coughing up blood (1/3 of patients)

√ shortness of breath.

√ chest pain.

√ weight loss.

√ fatigue.

√ crackles, rhonchi, wheezing, and inspiratory squeaks may be heard upon auscultation.

√ General findings may include digital clubbing, cyanosis, plethora, wasting, and weight loss.

√ Chest X-ray ⟶ Tramlines "cysts/ ring opacities"

	√ Percussion → Dullness.
Key 57	**According to BST/SIGN Asthma guidelines:** √ The first step of stable asthma management is: SABA (Salbutamol) + low dose corticosteroids (Beclomethasone).
Key 58	**How to clean the spacer used for inhalers?**  √ Wash it monthly, NOT weekly. √ Soak in detergent/ soapy warm water for 15 minutes. √ Then, allow it to air dry (No wiping with clothes or in the sun). √ When the plastic spacer is cloudy → does not matter. √ Replace the spacer every 12 month.

Key 59	**What test can differentiate Asthma from COPD?** → Post-bronchodilator FEV1 In Asthma and COPD, (FEV1/FVC) < 70% (<0.7) "there is airflow obstruction" In **Asthma**, FEV1 **significantly improves** after giving bronchodilators (FEV1 >12% improvement after giving a bronchodilator). (**reversible obstruction; improve post-bronchodilation)** **whereas in COPD, it remains < 0.7 even post-bronchodilation.** **(No significant improvement of post-bronchodilator FEV1).** If (FEV1/FVC) is **>** 0.7 from the start (before giving a bronchodilator), it is likely a **restrictive** cause such as **pulmonary fibrosis**.
Key 60	In some occasions, spirometry fails to detect asthma. → We use a "**treat to diagnose**" method by giving a 6-week course of inhaled corticosteroids or a few days of oral corticosteroids. If the symptoms e.g. wheezes, SOB, cough improve → Likely **Asthma**.

Key 61	**Suspecting pulmonary embolism (eg, long-time immobile, post-op, with fever, SOB, tachycardia…):** √ **The Immediate Ix** → **Chest X-ray** (to tule out other possible causes e.g. pneumothorax, pneumonia). √ **The Ix of choice** → **CTPA** (CT pulmonary angiography). **√ Once pulmonary embolism is suspected** → **DOACs (apixaban or rivaroxaban)**. **√** If pregnant or neither apixaban nor rivaroxaban is in the options → **LMWH**. "A treatment dose, while awaiting CTPA".
Key 62	**Bronchopleural Fistula** ◙ A bronchopleural fistula is an abnormal passageway (a sinus tract) that develops between the large airways in the lungs (the bronchi) and the space between the membranes that line the lungs (the pleural cavity). ◙ It a serious complication often caused by lung cancer surgery, but may also develop after chemotherapy, radiation, or an infection.

◙ It is usually asymptomatic, but when symptoms are present, they can be easily dismissed as they are symptoms which may be expected following lung infections and surgery, such as a persistent cough (with production of a clear to pink, frothy fluid when a fistula occurs within 2 weeks of surgery and often grossly pus-like later on), coughing up blood, or shortness of breath

◙ Lung cancer surgery: Pulmonary resection (removal of a lung or part of a lung) for lung cancer is by far **the most common cause** of a bronchopleural fistula. It is more likely to occur with a pneumonectomy (complete removal of a lung) than with procedures such as a lobectomy (removal of a lobe of the lung) or a wedge resection (removal of a wedge-shaped section of a lobe of the lung).

◙ It is also more common in those who have right-sided lung surgery.

◙ Diagnosis is usually made with a CT scan of the chest.

Also, X-ray may show it.

The first post-pneumonectomy X-ray would show high air-fluid level (normal after the lung resection, the space is filled with sterile fluid)

Then later when the fistula is persistent, there would be a drop in the air-fluid level, and an increase in air level (i.e. more black).

◙ Treatment involves repairing the fistula, which may be done via endoscopy, bronchoscopy, or open chest surgery.

Key 63

NICE updated their guidelines on the management of venous thromboembolism (VTE) in 2020.

◙ Some of the key changes include recommending the following:

√ The use of direct oral anticoagulants (**DOACs**, e.g., apixaban, rivaroxaban) as first-line treatment for most people with VTE.

√ The use of DOACs in patients with active cancer, as opposed to low-molecular weight heparin as was the previous recommendation.

√ Outpatient treatment in low-risk pulmonary embolism (PE) patients.

√ Routine cancer screening is no longer recommended following a VTE diagnosis.

◙ Very important note:

In **pregnant** women, both warfarin and DOACs are CONTRAINDICATED! Therefore, we use subcutaneous **LMWH** throughout the pregnancy and 6 weeks postnatal and until at least 3 months of treatment has been given.

◙ Anticoagulant therapy

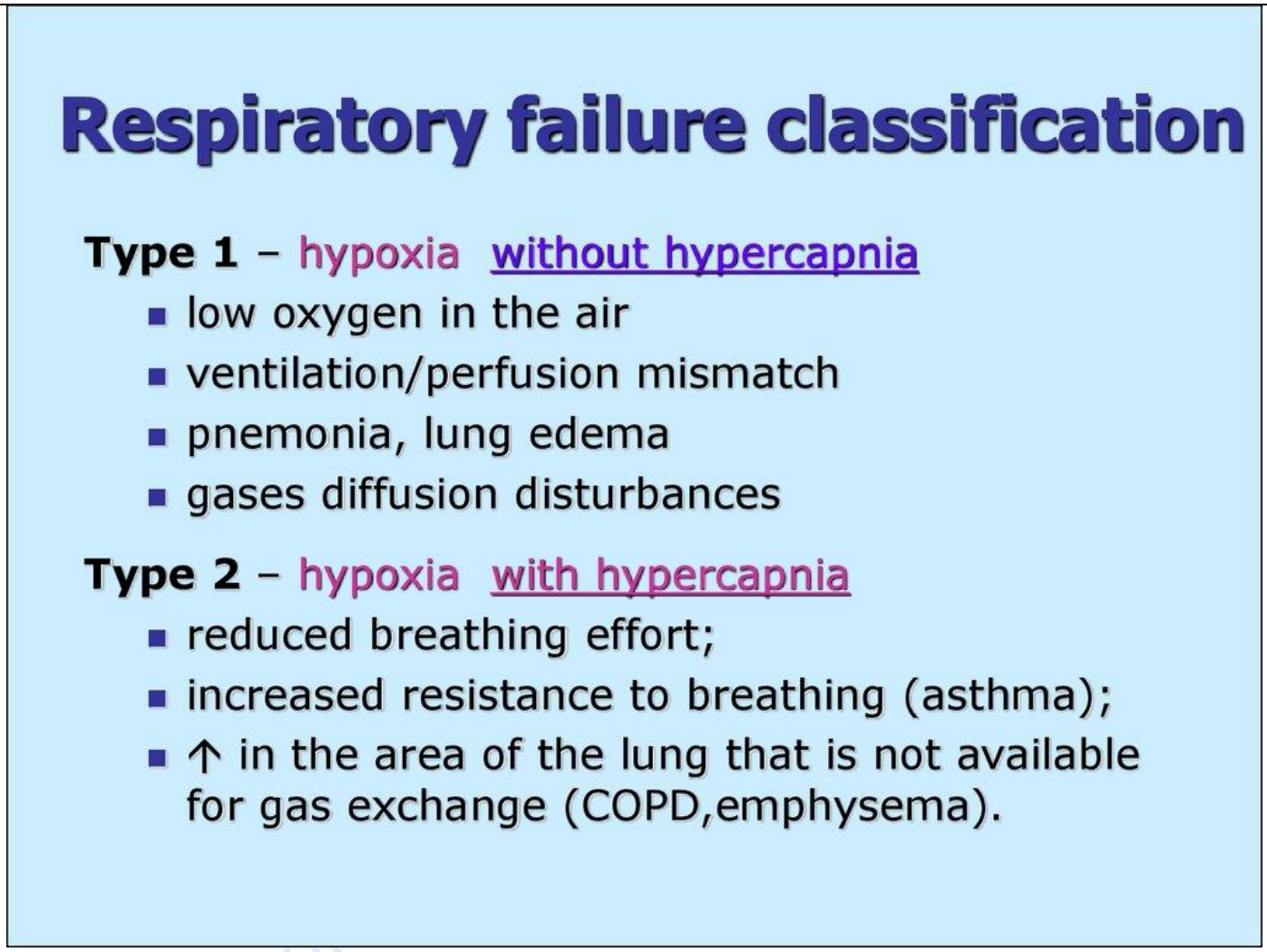
The cornerstone of VTE management is anticoagulant therapy. This was historically done with warfarin, often preceded by heparin until the INR was stable. However, the development of DOACs, and an evidence base supporting their efficacy, has changed modern management.

Choice of anticoagulant

• The big change in the 2020 guidelines was the increased use of DOACs

	apixaban or rivaroxaban (both DOACs) should be offered first-line following the diagnosis of a PE. • If neither apixaban or rivaroxaban are suitable then either LMWH followed by dabigatran or Edoxaban OR LMWH followed by a vitamin K antagonist (VKA, i.e. warfarin). • If the patient has active cancer: √ Previously LMWH was recommended. √ The new guidelines now recommend using a DOAC, unless this is contraindicated. • If renal impairment is severe (e.g. < 15/min) then LMWH, unfractionated heparin or LMWH followed by a VKA. --- • In short (for the exam): for PE, DVT, pick **apixaban or rivaroxaban** as first line. • If PE during pregnancy, or apixaban/ rivaroxaban not in options, pick **LMWH**. "Therapeutic dose"
Key 64	**A 45 YO had lung abscess and then went for lobectomy of the right lung. A chest drain has been inserted. 2 days later, the chest drain was removed and soon after, the patient developed dyspnea and his O2 sat went down to 85%. What is the immediate step?** → **Reinsert a chest drain**.

Key 65



In short:

√ Type 1 RF → low Po_2 (while Pco_2 is either low or normal).

√ Type 2 RF → low Po_2, high Pco_2.

Mnemonics:

Type 1 has 1 abnormal value which is (low Po_2).

Type 2 has 2 abnormal values which are (low Po_2 and high Pco_2).

***Example*:**

A 40 YO woman is brought to ER with chest pain and shortness of breath with the following observations:

- **HR: 115 beats per minute.**
- **RR: 26 breaths per minute.**
- **O2 saturation: 90%.**

Arterial blood gas shows:

- **PaO_2: 8 (Normal: >10).**
- **$PaCO_2$: 3.6 (Normal 4.7-6).**
- **Ph: 7.50 (Normal: 7.35-7.45).**
- **Bicarbonate: 21 (Normal: 22-26).**

◙ **What is the type of respiratory failure?**

◙ **And what is the abnormality regarding acidosis/alkalosis she is having?**

◙ **She has low PaO_2 but does not have high $PaCO_2$** (Hypoxia WITHOUT hypercapnia)**:**

→ **Type 1 respiratory failure.** PaCO2 here is low, **not high** as in type 2. Careful!

◙ **She has Ph of 7.5, so it is Alkalosis.**

	The CO_2, which is the acid is low, so it is respiratory. **Thus → Respiratory Alkalosis.**
Key 66	An 80 YO retired plumber presents to the ER with 2 weeks Hx of fever, left chest pain, cough, shortness of breath. He is a smoker. On auscultation, there are crepitations and decreased air entry at the left lang base. His temperature is 38.8. His chest x-ray shows blunting at the left costophrenic angle and left lower lobe consolidation. What is the most likely Dx? √ Given the fever + the duration of onset (2 weeks only), this indicates an infective cause rather than a chronic cause as cancer or mesothelioma. √ Also, the x-ray findings gows with pneumonia "consolidation" and effusion "blunting of the costophrenic angle". √ This is likely a case of pneumonia that had led to parapneumonic effusion.
Key 67	**A 60 YO man, smoker, presents with:** **SOB** **Chronic cough** **The symptoms have been worsening over the past 2 years.** **There are bilateral fine inspiratory crackles.** **FEV1/FVC ratio is 0.8**

	After giving salbutamol, this ratio remained almost the same (0.79) **What is the most likely Dx?** FEV1/FVC > 0.7 → Restrictive reason (e.g., **Pulmonary fibrosis**). FEV1/FVC < 0.7 → Obstructive reason (e.g., Asthma, COPD). If it was <0.7 from the beginning, we would check reversibilty to know if it is asthma or COPD. Think of Asthma if (FEV1/FVC) < 70% (<0.7) and **significantly improves** after giving bronchodilators. (**Reversible obstruction; improve post-bronchodilation) whereas in COPD, it remains < 0.7 even post-bronchodilation.** In this stem, it is already more than 0.7 from the start, so it is a restrictive cause such as lung fibrosis.
Key 68	**A 44 YO woman presents with sudden onset shortness of breath. She does not have neither fever nor chough. Her O2 sat is 89% on room air. Her Chest x-ray appears normal. Her HR is 102. Breath sounds are normal on auscultation. PCR for COVID 19 is negative.** **D-dimer is 1500 (N: <500ng/ml).** **The likely Dx → pulmonary embolism.**

	Sudden SOB + low O2 Sat. (hypoxia) + tachycardia + ↑ D-Dimer Think → **pulmonary embolism**. ◙ **Important Notes on pulmonary embolism:** • The "initial" investigation → Chest x-ray (to R/O other differentials). • The "most appropriate" test → CTPA (CT pulmonary angiography) goldstanderd. • Once PE is **suspected** → Start DOACs eg, apixaban, rivaroxaban "**treatment** dose".
Key 69	**Methotrexate Pneumonitis** Dry cough, Shortness of breath, Fever. Starts subacutely within the first year of methotrexate initiation. Chest X-ray → Hazy opacity, Prominent reticulation. **If suspected, the next step would be** → **High-resolution CT scan of the chest** This is to R/O other DDx and to confirm the diagnosis.

	After that, methotrexate needs to be stopped.
Key 70	◙ If a COPD patient present with (FEV1 **< 30%** predicted) ± √ oxygen saturations **less than or equal to 92% on room air**. → **Assess for long-term O2 therapy**. ◙ **If he is a smoker**, and you find (**offer smoking cessation interventions**) among the options, pick it. Long-term O2 therapy (LTOT) cannot be offered to patients who smoke (NICE).
Key 71	**A 62 YO long-time smoker man presents with 10 months of:** **√ chronic daily cough.** **√ coughing up large amounts of thick mucus every day.** **√ coughing up blood.** **√ weight loss.** **√ Fatigue** **√ Chest X-ray → Normal (only increased bronchovascular markings).** The most likely Dx → **Bronchiectasis**. The definitive diagnostic investigation → **High-resolution CT scan of chest**.

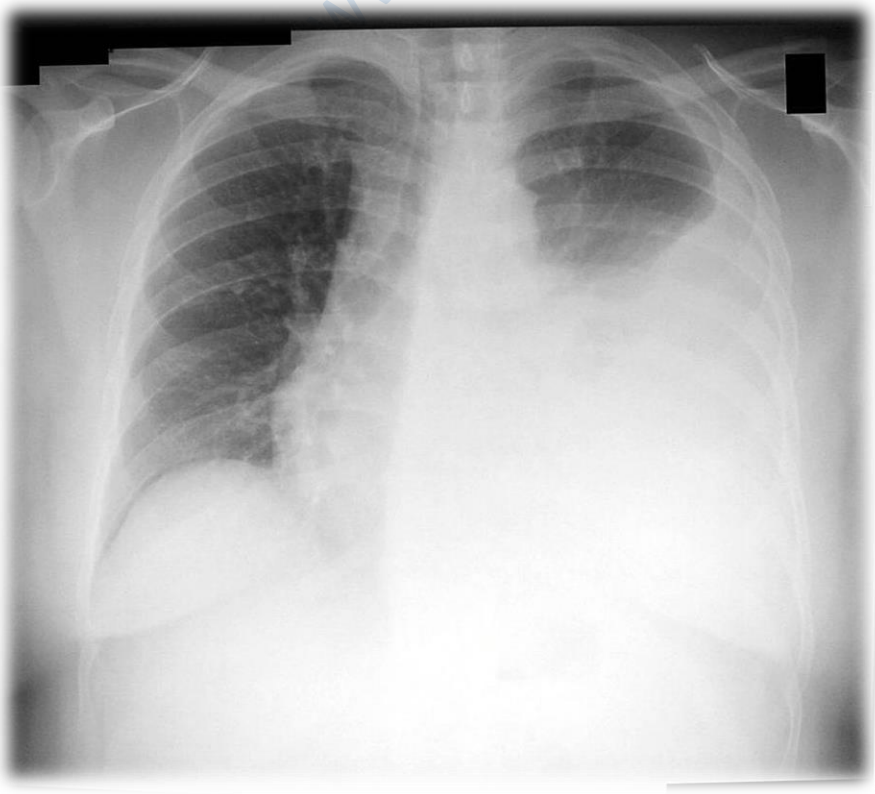
	◘ The features also make us suspect lung malignancy. However, there is no evidence of malignancy on Chest X-ray such as consolidations or focal masses. ◘ Also, large amount of mucous "productive cough" is a feature that goes more with bronchiectasis. ◘ Anyway, this patient would have CT chest to confirm Dx. ◘ The increased bronchovascular markings may indicate a recent respiratory tract infection **OR** due to chronic cough (eg, COPD) **OR** normal.
Key 72	**Post-operative + long-time immobile + tachycardia + SOB + ↓O2 saturation.** → **Pulmonary embolism.** → **Computerised tomography pulmonary angiogram (CTPA).** **→ Once PE "pulmonary embolism" is suspected** Treatment dose of → **Direct oral anticoagulants (eg, apixaban, rivaroxaban)** Previously, it was LMWH in suspected PE, and warfarin for confirmed PE. Do not get confused, the **prophylactic** dose can be given if after surgery a patient is expected to stay immobile. However, once PE is suspected or confirmed, a **treatment** dose should be given.

Key 73	**A 62 YO man long-time smoker presents with Breathlessness, cough and pleuritic chest pain that has been worsening over the past 10 days. There is dullness on percussion, decreased chest movements and absent breath sounds over the left lower lobe.** ◙ The most likely Dx → **Pleural effusion**. • The features mentioned goes with Pleural Effusion (*even without X-ray*): SOB, Absent breath sounds, Dullness, ↓ chest movements on the affected side. **Think → Pleural effusion**. • An important DDx here is **Pulmonary Consolidation** (mostly occurs due to **lobar pneumonia**). In consolidation, there is SOB and Dullness on percussion. However, in consolidation, there is **Bronchial** air sounds (ie, harsh) while in Pleural effusion, there is **absent** or decreased air sounds. • **2 Important Causes to remember for Pleural Effusion:** √ Lung malignancy. √ Pneumonia. Others → Congestive heart failure, Pulmonary embolism.

Congestive heart failure	transudate	– history of heart disease – edema, hypoxia
Cancer	exudate	– history of cancer (lung, breast; lymphoma) – intrathoracic mass
Bacterial pneumonia	exudate	– cough – fever – infiltrate
Pulmonary embolism	transudate or exudate	– dyspnea – immobilization – pleuritic chest pain

Key 74

A 65 YO woman long-time smoker presents with SOB, cough and pleuritic chest pain that has been worsening over the past 5 months. There is dullness on percussion, decreased chest movements and absent breath sounds over the left lower lobe. Chest X-ray was taken and it shows:



◙ The most likely Dx → **Pleural effusion**.

◙ The most appropriate action is **Diagnostic** OR **Therapeutic** **Pleural Aspiration**?

The answer is → **Therapeutic Pleural Aspiration**.

• **Therapeutic pleural aspiration** would aspirate large amount of the fluids which would relieve the breathlessness. In addition, a sample would then be sent to the laboratory for further testing.

• On the other hand, **diagnostic pleural aspiration** would aspirate a small amount (20-100 ml) → Not sufficient for symptomatic relief.

Key 75

Points on the Management of Acute COPD Exacerbation

◙ **The initial step to manage acute COPD exacerbation is:**

→ **24% - 28% Oxygen** **(not 100%) using "venturi face mask".**

◙ **Additional lines:**

√ Maintain O2 saturation between 88-92%.

√ Nebulised salbutamol. √ 100 mg IV hydrocortisone.

◙ **If still hypercapnic → Non-invasive ventilation** √ asked recently.

NICE recommends **non-invasive ventilation** (NIV) in patients with **COPD exacerbation** with persistent hypercapnic ventilatory failure despite optimal medical therapy, especially if Ph is 7.25-7.35 (respiratory acidosis).

Non-invasive ventilation (NIV):

- **Also called BiPAP (Bi-level Positive Airway Pressure)**
- **→ Delivering oxygenated air via a tight-fitting face mask by positive pressure.**

Example: A chronic smoker presents with SOB, high RR, O2 saturation of 86%. He was given 4L 28% Oxygen but his arterial blood gas still showing respiratory acidosis (Ph 7.33, PaCO2 is high). Next step → Non-invasive ventilation.

Key 76

The Causative Organism in Pneumonia:

Remember:

Pneumonia developed **after influenza** (**Flu**) → **Staph**. **Aureus**. (50% bilateral).

Example:

A 22 YO man presents with 2 days of shortness of breath, hemoptysis and cough. He has had runny nose, lethargy, sore throat, and high fevers for the past week. His current observations are as follow:

Pulse: 138 beats/ minute, temperature: 39.4 degrees, BP: 82/50 mmHg, respiratory rate: 35 breaths/minute.

There are inspiratory crackles on auscultation.

His chest X-ray shows bilateral middle and lower lobe **cavitations**.

His lab results are normal except for an elevated WBC count.

The most likely causative organism is → Staphylococcus aureus.

• Pneumonia (lobe cavitations, crackles, SOB, hemoptysis) that develop after a period of influenza (runny nose, sore throat, high fevers) is mostly staphylococcal pneumonia.

• Also, 50% of the cases of staph. Pneumonia have (bilateral) infection like in this stem (bilateral cavitations).

Hints To Know the Causative Organism in Pneumonia
• Pneumonia developed **after influenza** (**Flu**) → **Staph**. **Aureus**. (50% bilateral).
• **Herpes Labialis** → **StreptococcaL** (Pneumococcal).
• **Erythema Multiforme** → **Mycoplasma**
• **Atypical features: young adult, dry cough, bilateral consolidation** → **Mycoplasma**
• **HIV** with **CD4 < 200 ± desaturation on exercise** → **Pneumocystis Jirovecii** (Carinii)
• Pneumonia after Hx of **Exposure to Water + low Na + Low lymphocyte, staying in a hotel** → **Legionella**

Key 77

CURB-65 Score

The management of patients with **community-acquired pneumonia** is usually determined according to a risk stratification process using a scoring system called **CURB-65**.

The CRB-65 score is as follows:

Criterion	Marker	Points
C	Confusion	1
U	Urea > 7 mmol/L	1
R	Respiration rate ≥ 30 /min	1
B	Blood pressure: systolic ≤ 90 mmHg and/or diastolic <= 60 mmHg	1
65	Age ≥ 65 years	1

NICE recommend, in conjunction with clinical judgement:

- **home**-based care for patients with a CURB-65 score of 0
  - Oral amoxicillin is generally used first-line.

- **hospital** assessment for all other patients, particularly those with a CURB-65 score of 2 or more.

The CURB-65 score also correlates with an increased risk of mortality at 30 days with patients with a CURB-65 score of 4 approaching a 30% mortality rate at 30 days.

Example (1):

A 56-year-old man presents to A&E department with 2 weeks of coughing and fever. The patient is alert, and his chest auscultation reveals bi-basal crepitations. His vitals are as follows:

Heart rate 96 beats/ minute, Blood pressure: 92/65 mmHg, Temperature 39.2

Respiratory rate 33 breaths/minute, Oxygen saturation 94% on room air.

His serum urea is 6 mmol/L.

What is his CURB-65 score?

Confusion: 0 | Urea: 0 | RR: **1** (≥30) | BP: 0 | Age: 0

So, his CURB-65 score is → **1**.

Example (2):

A 66-year-old man presents with a 3-day history of productive cough, fever, and worsening shortness of breath. His medical history includes controlled hypertension and hyperlipidaemia. On examination, his respiratory rate is 32 breaths per minute, blood pressure is 92/63 mmHg, heart rate is 85 beats per minute, and his oxygen saturation is 95% on room air. He is alert and oriented. What is his CURB-65 score?

Answer: → **2**.

Explanation:

- **1 point for age ≥ 65.**
- **1 point for respiratory rate ≥ 30 breaths per minute.**

These factors give a CURB-65 score of 2, which helps guide the severity of pneumonia and the need for potential hospitalization.

Key 78

Interesting Scenario on Lung Disease

A 51-year-old man presents to the ER complaining of dry cough and shortness of breath for the past five months. His heart rate is 92, blood pressure 140/82, oxygen saturation 89%. On examination: he looks pale, exhausted, and has finger clubbing. Chest auscultation reveals bilateral fine crepitations. Pulmonary function test (spirometry) shows:

FEV1 65%

FVC 57%

FEV1/FVC 0.9

What is the most likely diagnosis?

A) Asthma.

B) Bronchiectasis.

C) Atelectasis.

D) Pulmonary fibrosis.

E) Cystic fibrosis.

We can answer this question using 2 ways:

- **The first way → by excluding**:

• Dry cough → unlikely bronchiectasis (as in bronchiectasis → ↑↑ sputum).

- There is no chest pain here → unlikely atelectasis.
- There is no wheeze → unlikely asthma.
- Lack of relevant history in the past (eg, recurrent chest infections)

→ unlikely cystic fibrosis.

The remaining option is → Pulmonary fibrosis.

The second way → by spirometry analysis:

- In the **obstructive** lung disease (Asthma, COPD, Bronchiectasis, Cystic fibrosis):

→ FVC **>** 80% and FEV1/FVC **<** 0.7.

- In the **restrictive** lung disease (Pulmonary fibrosis, interstitial lung disease):

→ FVC **<** 80% and FEV1/FVC **>** 0.7.

In the scenario above: FVC < 80% and FEV1/FVC > 0.7. → ie, restrictive.

The only **restrictive** lung disease option here is → Pulmonary fibrosis.

NOTE: Of the given options above, **clubbing** can be seen in:

Bronchiectasis, **Pulmonary fibrosis**, and **Cystic fibrosis**.

	CLUBBING Causes Mnemonic: **C** → Cyanotic heart disease – Cystic fibrosis. **L** → Lung cancer – Lung abscess. **U** → Ulcerative colitis. **B** → Bronchiectasis. **B** → Benign mesothelioma. **I** → Infective endocarditis – Idiopathic pulmonary fibrosis – interstitial lung disease. **N** → Neurogenic tumors. **G** → Gastrointestinal disease (eg, cirrhosis – enteritis – Celiac – GIT lymphoma).
Key 79	**Important Scenario on COPD Exacerbation Management** A 62 YO man with a history of chronic obstructive pulmonary disease is brough to the ER complaining of sudden onset of shortness of breath. He is using his accessory muscles to breathe and there is bilateral wheezing. His RR is 29 and O2 is 80%. He was immediately started on oxygen with FiO2 24% via venturi mask. He was given salbutamol with ipratropium and 100mg IV hydrocortisone. Chest X-ray shows bilaterally hyperinflated lungs. After this initial treatment, his ABG shows low Ph (7.32) and high paCO2. And his oxygen saturation is still low (83%).

What is the most appropriate next step in management?

→ **Non-invasive ventilation**.

• He still has respiratory acidosis after the medical treatment + Low O_2 sat. +

There are no indications for invasive ventilation (intubation) such as impaired mental status or respiratory arrest. So, we go for the next step first. The next steps are → non-invasive ventilation (NIV). If failed → Intubation.

*• The **Global Initiative for Chronic Obstructive Lung Disease (GOLD)** no longer recommends the routine use of **aminophylline** due to its limited efficacy and higher risk profile.*

Points on the Management of COPD Exacerbation "imp"

- **24% - 28% Oxygen (~~not 100%~~) using "venturi face mask".**
- **Maintain O2 saturation between 88-92%.**
- **Nebulised salbutamol (with ipratropium bromide).**
- **Corticosteroids: 100 mg IV hydrocortisone or 30 mg oral prednisolone stat. (prednisolone should be continued as 30 mg OD for 7-14 days).**
- **Still no response? → IV aminophylline. (Rarely used now, rarely the answer X).**

	• **If purulent sputum, fever, high CRP → Give Antibiotics.** • **After giving all these medical options, if he is still dyspnoeic, with impaired blood gas showing respiratory acidosis (low pH, high $PaCO_2$):** → **Non-Invasive Ventilation (NIV).** NICE recommends **non-invasive ventilation** (NIV) in patients with COPD exacerbation especially if pH is 7.25-7.35 (respiratory acidosis). • **If NIV failed or there is impaired mental status, respiratory arrest, high aspiration risk → Intubate and ventilate (invasive ventilation).**
Key 80	**Long-Term Oxygen Therapy (LTOT)** • Most commonly prescribed for COPD with severe hypoxemia. • It usually improves survival if given for a minimum of 15 hours a day. (◘) **Assess** the need for LTOT "**Long-Term O2 Therapy**" if any of the following: **√** Very severe airflow obstruction (FEV1 **< 30%** predicted). **√** Oxygen saturations **less than or equal to 92% on room air**. **√** Cyanosis. **√** Polycythaemia. **√** Peripheral oedema. **√** Raised jugular venous pressure.

	(◘) **Offer** LTOT "**Long-Term O2 Therapy**" if any of the following: √ If **PaO2 <7.3** (normal: 10-14 kPa). **Or** √ If **PaO2 7.3 – 8.0** (normal: 10-14 kPa) + **one** of the following: Pulmonary hypertension / Secondary polycythemia / Peripheral edema. ◙ **Notes:** √ Patients who receive long-term oxygen therapy should breathe supplementary oxygen for at least 15 hours a day. √ Long-term O2 therapy **cannot** be offered to patients who smoke (NICE).
Key 81	**Pancoast Tumour** A tumour of the apex of the lung (located at the top end of either the left or the right lung). Most Pancoast tumours are non-small cell lung cancer. It typically spreads to the nearby tissues such as the ribs, vertebrae, ipsilateral sympathetic chain and brachial plexus. ◙ **Manifestations**: • It can invade the ipsilateral **cervical sympathetic chain** → leading to **Horner's syndrome** (ipsilateral Ptosis, Miosis, anhidrosis).

• It can invade the ipsilateral **brachial plexus** → leading to wasting of intrinsic muscle of the hand, paraesthesia of the medial aspect of the arm, pain in the arm and shoulder.

◙ **Investigations** (**important**):

• If the question asks about the most appropriate (**NEXT**) test:

→ Chest X-ray.

• If asks about the most appropriate (**diagnostic test**):

→ MRI chest (more specific and sensitive than CT scan in pancoast tumor).

(**Note**: if **biopsy** is to be taken later on, this would be done by percutaneous needle or supraclavicular incision instead of bronchoscopy as the tumor is peripherally located).

◙ **Example**:

A 57-year-old man who is a smoker presents with left-sided chest pain and left shoulder pain that worsens on taking deep breaths. He also has a progressive shortness of breath over the past 6 months. His left eye shows miosis and partial ptosis. He has an enhanced sensitivity to touch on his left arm. There is wasting small muscle of the left hand. What is the most appropriate diagnostic test among the following options?

Options: CT chest / Chest X-ray / Chest MRI / Shoulder MRI / Bronchoscopy.

• The most likely diagnosis here is left-sided **pancoast tumor**.

• Hx of smoking, worsening shortness of breath +

	√ Sympathetic chain invasion causing Horner's syndrome (miosis, ptosis). √ Brachial plexus invasion causing wasting of hand muscle, shoulder pain. • The answer here is → Chest MRI. (The most appropriate **diagnostic** test). • If asks about the most appropriate (**NEXT**) test → Chest X-ray. **Note**: if **biopsy** is to be taken later on, this would be done by percutaneous needle or supraclavicular incision instead of ~~bronchoscopy~~ as the tumor is peripherally located).
Key 82	**Reminder**: **On managing asthma attack**, if [**Silent Chest**] develops: → **Intubation**.
Key 83	**Reminder**: **On managing tension pneumothorax:** → Needle thoracocentesis (needle decompression) is used first as a rapid treatment to buy time until a more definitive treatment (chest drain) is put in place.

Key 84

Diagnosis of Asthma:

• **Mostly Clinically** (eg, chronic cough, Dyspnea, wheezes, worse at night or early morning or after exposure to a trigger eg, pollen, pets, cold air, perfumes. History of atopy eg, eczema, hay fever. Family Hx of atopy or asthma).

• **First-line** investigation → **Spirometry**.

Spirometry in asthma → obstructive pattern (ie, FEV1/FVC ratio is **< 70**%).

After the patient takes a bronchodilator, FEV1 would improve by > **12**%.

ie, Asthma shows a reversible obstruction so that FEV1 value improves post-bronchodilation) whereas in COPD, it remains < 0.7 even after-bronchodilation.

• Important and asked previously: if a spirometry is already tried and it is normal but you still suspect asthma (eg, the patient has atopy, family history of asthma, he is clinically asthmatic) → **Peak flow diary**.

√ In the exam, if you suspect asthma, pick the investigation → **Spirometry.**

√ If spirometry is normal and asthma is still suspected → **Peak flow diary**.

√ After establishing a Dx of Asthma (using a spirometry), to help determine the appropriate time for the use of bronchodilators → **Peak Flow Rate Diary**.

Key 85

Pleural Fluid Analysis:

Scenario:

A 66-year-old woman presents to the ER with persistent cough, chest pain and shortness of breath for the past few months. She is non-smoker. Her vitals show tachypnea, normal pulse rate and normal temperature. Chest X-ray shows

right-sided pleural effusion. Thoracocentesis is done and pleural fluid analysis shows fluid/serum protein ration of 0.7. What is the most likely diagnosis?

A) Nephrotic syndrome.

B) Heart failure.

C) Benign ovarian tumour.

D) Bronchial carcinoma.

E) Heart failure.

Answer → D.

• Thoracocentesis of a pleural effusion → sample for pleural fluid analysis:

• **Pleural fluid analysis:**

√ If fluid/serum protein ratio is **< 0.5**, think → **Transudative** (eg, heart failure, cirrhosis, nephrotic syndrome).

√ If fluid/serum protein ratio is **> 0.5**, think → **Exudative** (eg, bronchial carcinoma, benign ovarian tumour resulting in Meigs' syndrome).

Bronchial carcinoma is more common especially if there is persistent cough.

Also, Meigs' syndrome would have other symptoms such as ascites, pelvic pain.

Remember:

Persistent cough that is not relieved by antibiotics → do chest X-ray.

Key 86	**In patients with community acquired pneumonia (CAP) who have allergy to penicillin.** **(CAP: Productive cough, wheezing, dyspnea, fever, basal crackles).** → **Doxycycline**. Other: Clarithromycin. However, it is contraindicated if the patient is on **statins**. Community acquired pneumonia that does not need hospital admission is treated with (**amoxicillin**). However, if the patient is **penicillin-allergic** (which means they cannot be given amoxicillin, co-amoxiclav or flucloxacillin) → **Doxycycline** would be appropriate to use. Another usable antibiotic is **clarithromycin**; but it is contraindicated if the patient is on **statins** (eg, atorvastatin).
Key 87	**In patients with staphylococcus aureus pneumonia:** → **Flucloxacillin**.
Key 88	**(Important Update on Managing VTE):** **Once VTE -venous thromboembolism- is suspected or confirmed:** • If one of these two **DOACs -direct oral anticoagulants-: "apixaban or rivaroxaban"** is within the options and the patient is not pregnant, pick it as these 2 DOACs have become the **first line** for venous thromboembolism (**VTE**); Pulmonary embolism (**PE**), Deep vein thrombosis (**DVT**) (**Initiated once PE is suspected or confirmed**). • What if **a different DOAC** is in the options (not apixaban or rivaroxaban), (eg, **dabigatran**)? → Pick **low molecular weight heparin LMWH eg, enoxaparin**.

	LMWH can be given for 5 days and then shifted to dabigatran. • What if the patient is **pregnant**? → pick subcutaneous **LMWH**. (Both warfarin and DOACs are contraindicated in pregnancy).
Key 89	Sudden onset of **cough (that can be productive)** + **polyphonic wheezes** in adults, in absence of asthma history, think → **Acute bronchitis**.
Key 90	Stab wound into the chest + ↓ BP + ↓ O2 saturation + Dullness on percussion and absent breath sounds in the same stabbed area: **Think** → Hemothorax. **Perform** → Surgical chest drain. "To evacuate blood from pleural space". **Remember**: Needle thoracocentesis is used for tension pneumothorax, where the percussion would be hyperresonance, not dull like in this case. Needle thoracocentesis is then followed by medical chest drain (smaller than surgical chest drain and allows for air not blood drainage).
Key 91	Shortness of breath + Tachypnea + Tachycardia + Respiratory Alkalosis with low paO2 (<10) Think → Pulmonary Embolism.

(Remember, respiratory alkalosis with similar presentation can also be seen in panic attacks. However, paO2 in panic attacks is normal.

Key 92

Atypical Pneumonia

• Common Causative Organisms:

Mycoplasma pnemoniae, Legionella pnemoniae, Chlamydophila pnemoniae.

• Features:

√ It tends to occur in closed communities as outbreaks (eg, **military barracks**, **hotels**, **water pools**).

√ Atypical pneumonia tends to have a milder fever and to be less acute, less severe than the typical bacterial pneumonia.

• Treatment:

√ Oral clarithromycin, or oral doxycycline.

√ In pregnant women: oral erythromycin.

Key 93

Pertussis (Whooping Cough)

• The Features

√ Cough: frequent, severe, paroxysmal bouts of cough.

√ The cough is followed by a "whooping" sound as the patient tries to inhale.

	√ Post-tussive episodes of vomiting (after cough spells). • **The organism** → Bordetella pertussis. • **Dx** → Pertussis serology. (**PCR** testing from a **nasopharyngeal** swab has become the **gold standard** for diagnosing pertussis in adults. Serology can be helpful in a later stage of the disease -eg, after 2 to 3 weeks of the disease). **• Management:** √ Pertussis is a notifiable disease. √ Management is with → Macrolides eg, clarithromycin or azithromycin.
Key 94	**Respiratory Failure (Type 1 VS Type 2)** • Type 1 respiratory failure occurs when the respiratory system cannot adequately provide oxygen to the body, leading to hypoxemia. • Type 2 respiratory failure occurs when the respiratory system cannot sufficiently remove carbon dioxide from the body, leading to hypercapnia. ◘ (So, **$PaCO_2$** is normal or low in type 1 RF, but high in type 2 RF). ◘ **PaO2** is low in both type 1 and 2 RF.

	Only low paO2 (without high paCO2) → Type 1 respiratory failure. Low paO2 + High PaCO2 → Type 2 respiratory failure.
Key 95	An asthmatic patient is on short acing beta agonist (SABA) and low dose inhaled corticosteroids. He is adherent to treatment but still having shortness of breath (especially nocturnal). The next step → Add LABA (eg, Formoterol or Salmeterol).
Key 95	**Acute Management of Tension Pneumothorax** ***Scenario*** A 64-year-old woman presents to the Emergency Department with sudden onset of shortness of breath and pleuritic chest pain on the right side following a road traffic accident. On examination, she is tachypnoeic with a respiratory rate of 30 breaths per minute, tachycardic with a pulse of 115 beats per minute, and her oxygen saturation is 85% on room air. She appears anxious and has diminished breath sounds on the right side of her chest with associated hyperresonance on percussion. Tracheal deviation to the left is noted. Her blood pressure is 85/55 mmHg. Which of the following is the most appropriate initial action? A) Arrange for an immediate chest X-ray. B) Perform needle decompression at the fifth intercostal space in the midaxillary line on the affected side. C) Insert a chest drain at the fifth intercostal space in the midaxillary line without further delay. D) Arrange an immediate CT chest, abdomen and pelvis.

E) Initiate intravenous fluids and arrange urgent transfer to the intensive care unit.

Correct Answer → B) Perform needle decompression at the fifth intercostal space in the midaxillary line on the affected side**.**

Explanation:

The patient has a tension pneumothorax, which is a life-threatening condition that requires immediate needle decompression to relieve the pressure and restore normal breathing. This procedure provides temporary relief by releasing the trapped air in the pleural space, which is causing the pressure on the lungs and heart.

Incorrect Options:

A) Arranging for a chest X-ray would delay the immediate life-saving intervention needed for tension pneumothorax.

C) Inserting a chest drain is necessary after needle decompression to convert the tension pneumothorax into a simple pneumothorax and to allow continued evacuation of air and re-expansion of the lung. However, it is **not** the immediate first step because needle decompression provides quicker relief of the life-threatening pressure.

D) Arranging a CT scan would also delay the immediate treatment required.

E) Initiating IV fluids and transferring to ICU are supportive measures but do not address the immediate need to relieve the pressure from the pneumothorax. (ABCD).

Summary of Tension Pneumothorax Management

◙ **Immediate Needle Decompression:**

- Indicated for patients with signs of tension pneumothorax, a life-threatening condition.
- Rapid intervention is crucial to prevent cardiovascular collapse.
- Perform needle decompression at the fifth intercostal space in the midaxillary line.
- This procedure provides temporary relief from intrathoracic pressure build-up.
- Immediate priority is to stabilize the patient's cardiorespiratory status by relieving pleural pressure.

◙ **Subsequent Steps:**

- After needle decompression has converted the tension pneumothorax into a simple pneumothorax, place a chest drain (tube thoracostomy) to allow continued evacuation of air from the pleural space and re-expand the lung.

◙ **Diagnosis:**

- Based on clinical signs: respiratory distress, hypoxia, hypotension, tachycardia, tracheal deviation, diminished breath sounds, and hyperresonance on percussion.

	◦ These findings justify immediate needle decompression **without** waiting for a chest X-ray. ◙ **Notes:** The 10th edition Advanced Trauma Life Support (ATLS) recommends needle decompression at the 5th intercostal space in the midaxillary line. If this is not an option, use the 2nd intercostal space midclavicular line.
Key 96	**Summary: Pneumothorax Types and Management** **Pneumothorax** is the presence of air in the pleural space, classified into: **◙ Primary Spontaneous Pneumothorax (PSP):** ◦ **Characteristics:** Affects healthy young individuals, often tall, thin males. Caused by rupture of small air blisters (blebs). ◦ **Symptoms:** Sudden sharp, pleuritic chest pain, and shortness of breath. ◦ **Example:** 20-year-old male with sudden chest pain and shortness of breath. ◦ **Management:** ▪ **Small PSP (<2 cm from chest wall):** Observation and high-flow oxygen, with repeat chest X-rays. ▪ **Large PSP (≥2 cm from chest wall or symptomatic):** Needle aspiration; if unsuccessful or unstable, chest drain insertion.

◙ Secondary Spontaneous Pneumothorax (SSP):

- **Characteristics:** Occurs in patients with lung diseases (COPD, asthma, cystic fibrosis, tuberculosis).
- **Symptoms:** Sudden dyspnoea, pleuritic chest pain, hypoxia, possibly cyanosis.
- **Example:** 65-year-old male with COPD and sudden dyspnoea.
- **Management:** Chest drain insertion regardless of size, with hospitalisation and monitoring.

◙ Tension Pneumothorax:

- **Characteristics:** A life-threatening emergency resulting from trapped air causing increased intrathoracic pressure, leading to decreased cardiac output and respiratory failure if not treated promptly.
- Often due to trauma, mechanical ventilation, or iatrogenic causes (e.g., during central line insertion, lung biopsy, positive pressure ventilation).
- **Symptoms:** Severe shortness of breath, hypotension, tracheal deviation, distended neck veins, decreased breath sounds, hyperresonance, cyanosis.
- **Note:** Not all symptoms need to be present; immediate intervention is critical. A chest X-ray is unnecessary before intervention.
- **Example:** 30-year-old female in a car accident with severe shortness of breath and tracheal deviation.
- **Management:** Immediate needle decompression **without** waiting for a chest X-ray, followed by chest drain insertion to prevent recurrence and allow lung re-expansion.

Key 97

Diagnosis of Pancoast Tumor

Scenario

A 67-year-old woman presents to the clinic with a four-month history of worsening shoulder pain and a persistent cough. She mentions a recent onset of tingling and weakness in her hand. She is a former smoker, having smoked 30 cigarettes a day for 20 years, but quit 15 years ago. On examination, there is muscle wasting in the hand and mild ptosis on the left side. Which is the most appropriate initial investigation?

A) Chest X-ray.
B) MRI of the chest.
C) Full blood count.
D) Electrocardiogram.
E) Ultrasound scan of the shoulder.

Correct Answer → A) Chest X-ray.

Explanation:

- The patient's symptoms, including shoulder pain, muscle wasting, and ptosis, suggest a Pancoast tumor (superior sulcus tumor).
- A **chest X-ray** is the initial investigation to identify the presence of a lung mass, which is essential for diagnosing a Pancoast tumor.

- **Horner's Syndrome:** Horner's syndrome includes ptosis (drooping eyelid), miosis (constricted pupil), and anhidrosis (lack of sweating) on the affected side of the face, often caused by disruption of the sympathetic nerves.

Summary on Pancoast tumour:

- **Pancoast tumor** is a type of **lung cancer** located at the **top** (**apex**) of the lung that can **invade local structures** such as ribs and vertebrae, causing specific symptoms due to pressure and compression on nearby nerves and tissues.
- **Symptoms**: Shoulder pain, Arm pain and weakness, Tingling and muscle wasting in the hand, Horner's syndrome (ptosis, miosis, anhidrosis) due to compression of sympathetic nerves. So, do chest X-ray first to look for the lung mass (top).

Key 98

Electrolyte Imbalance in Small Cell Lung Cancer

Scenario

A 72-year-old man attends the respiratory clinic with complaints of a persistent cough and unexplained weight loss over the past ten months. He has been coughing up phlegm streaked with blood. He has a significant smoking history of 55 pack-years and reports progressive lethargy. He denies any recent travel history. A chest X-ray is seen below. What is the most likely electrolyte imbalance?

A) Hypocalcaemia.
B) Hypokalaemia.
C) Hyperkalaemia.

D) Hyponatraemia.
E) Hypermagnesaemia.

Correct Answer → D) Hyponatraemia**.**

Explanation:

√ The patient's presentation, including weight loss, hemoptysis, and significant smoking history, suggests a possible diagnosis of small cell lung cancer (SCLC).

√ SCLC is often associated with paraneoplastic syndromes, such as syndrome of inappropriate antidiuretic hormone secretion (SIADH), leading to hyponatraemia.

√ Symptoms of hyponatraemia can include nausea, headache, confusion, and seizures.

Summary:

• Small cell lung cancer is associated with SIADH.

• SIADH leads to water retention and hyponatraemia.

• Symptoms include persistent cough, hemoptysis, weight loss, and lethargy due to SCLC, with hyponatraemia presenting as nausea, headache, confusion, and seizures.

• Prompt identification and management of the underlying cause are critical to address electrolyte imbalance and the primary malignancy.

Key 99

A Lung Disease due to Methotrexate + Its Imaging

Scenario

A 58-year-old woman with a 15-year history of rheumatoid arthritis presents to the clinic with increasing shortness of breath and a persistent dry cough over the past five months. She has been on methotrexate therapy for the past six years. Physical examination reveals clubbing of the fingers. Her pulmonary function tests show an FEV1/FVC ratio of 0.78. A chest X-ray reveals reticular markings predominantly in the lower zones. What is the most appropriate next step?

A) Increase the dose of methotrexate.
B) Initiate treatment with corticosteroids.
C) Perform a High-Resolution CT (HRCT) scan of the chest.
D) Refer to a respiratory specialist for bronchoscopy.
E) Stop methotrexate immediately.

Correct Answer → C) Perform a High-Resolution CT (HRCT) scan of the chest.

Explanation:

√ High-Resolution CT (HRCT) is essential for evaluating interstitial lung disease (ILD), which can be a complication of methotrexate.

√ A **restrictive pattern** on pulmonary function tests is characterized by a reduced FEV1/FVC ratio **below 0.8**, which suggests that the lungs have lost some of their volume and elasticity, typically senn in ILD.

√ HRCT is considered the gold standard for diagnosing both interstitial lung disease and bronchiectasis.

Incorrect Options:

A) Increasing the dose of methotrexate could exacerbate potential methotrexate-induced lung disease, which is counterproductive if ILD is present.

B) Corticosteroids might be considered if ILD is confirmed, but they should not be initiated without a definitive diagnosis via HRCT.

D) Bronchoscopy is not the first-line investigation for suspected ILD. It is more invasive and less useful than HRCT in this context.

E) Stopping methotrexate may be necessary if ILD is confirmed, but this decision should be based on the results of HRCT.

Summary:

- Methotrexate can cause → interstitial lung disease.
- Clubbing and a restrictive pattern on pulmonary function tests suggest

→ Interstitial lung disease.

	• → High-Resolution CT (HRCT) is the best imaging modality for further assessment, offering detailed images to confirm the diagnosis. • Early detection and appropriate management of ILD are crucial to prevent further lung damage.
Key 100	**Remember: For the Causative Organism of Pneumonia:** • Multilobar involvement and cavitation often point to → Staphylococcus aureus. • Co-infection with influenza makes → Staphylococcus aureus a likely pathogen. • However, **the most common bacteria** responsible for bacterial pneumonia in general is → Streptococcus pneumoniae.
Key 101	**Why 24-28% Oxygen via a Venturi Mask and Not 100% O_2 in COPD?** • Patients with COPD are particularly vulnerable to **hypercapnia** (elevated CO2 levels) when exposed to uncontrolled, high-flow oxygen. This is because giving high concentrations of oxygen can impair the respiratory drive in these patients, leading to **CO2 retention** and **respiratory acidosis**. • Using a **Venturi mask**, which delivers a precise and controlled oxygen concentration, is the preferred approach in managing COPD patients. It helps avoid the risk of worsening hypercapnia by preventing excessive oxygen delivery.

• Starting with an oxygen concentration of **24-28%** is appropriate, as it ensures sufficient oxygenation while minimizing the likelihood of CO2 retention.

• Administering **high-flow oxygen** (such as 100% via a non-rebreather mask) can rapidly worsen CO2 retention in COPD patients. This makes high-flow oxygen inappropriate unless there is **significant hypoxaemia** present. For instance, if the oxygen saturation on room air is above 85-88%, high-flow oxygen should generally be **avoided**.

• Additionally, **nasal cannula oxygen** at 2 or 4 L/min delivers an uncontrolled flow of oxygen and is therefore not ideal for COPD patients who require careful titration of oxygen levels.

• If medical therapy fails, **non-invasive ventilation (NIV)**, such as **BiPAP** (Bilevel Positive Airway Pressure), is often used to support the patient's breathing. NIV can help improve gas exchange and reduce the work of breathing, offering an important intervention before considering more invasive methods.

• In more severe cases of respiratory failure, **intubation and mechanical ventilation** may be considered. However, this is typically reserved for situations involving significant impairment, such as **altered mental status** (e.g., Glasgow Coma Scale < 8) or **respiratory arrest** (e.g., a silent chest). Additionally, one of the

	indications for intubation and mechanical ventilation is if **NIV has been tried and failed** to improve the patient's respiratory function. **Note (For Reading):** • ***CPAP (Continuous Positive Airway Pressure)*** *is a type of* ***non-invasive ventilation (NIV)****. CPAP delivers a constant flow of air at a set pressure to keep the airways open, which is particularly useful in conditions like obstructive sleep apnoea or in acute respiratory distress where maintaining airway patency is crucial.* • *In COPD exacerbations, as a type of* ***NIV****,* ***CPAP*** *is less commonly used compared to* ***BiPAP (Bilevel Positive Airway Pressure)*** *because* ***BiPAP*** *provides two levels of pressure: higher pressure during inhalation and lower pressure during exhalation, which helps reduce the work of breathing and is more beneficial for patients who are retaining CO2, as often seen in COPD.*